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Contents:

	PAGE
The Electrical Industry	493
The Cable and Wireless Fusion	494
The E.D.A.	494
Central England Electricity Scheme	494
Heavy Electric Traction in Italy, by Theodore Rich (*illus.*)	495
Electricity Distribution, by C. G. Watson	498
Domestic Water Heating, by R. J. Hebbert (*illus.*)	500
Coupons in Trade Advertisements (*illus.*)	503
Reviews	504
Business and Industrial Notes	505
Lighting and Power Notes	509
Tramway and Railway Notes	510
Telegraph and Telephone Notes	511
Radio Notes	511
Contract Information	511
Forthcoming Events	513
Notes	513
Our Personal Column	516
Financial Section –	
New Companies Registered	518
Official Returns of Electrical Companies	518
Financial Section—*contd.*	
City Notes	519
Stocks and Shares	521
Our Foreign Electrical Trade	523
The Ideal Home Exhibition (*illus.*)	524
Modern Sub-Station Equipment (*illus.*)	525
Parliamentary News	526
New Electrical Devices, Fittings, and Plant (*illus.*)	527
The Electrical Development Association	528
Central England Electricity Scheme, 1928 (*illus.*)	529
The Overhead Lines Association (*illus.*)	530
Electrodeposition of Silver	532
A New Wiring System (*illus.*)	533
Legal	533
The Electrical Imports of India	534
Correspondence—	
More Points on Studying	534
"Fair Trading"	535
Insulation Impregnation	535
Trade Mark Applications	535
Published Specifications	535
New Work for Contractors	536

The Electrical Industry.

IT must be taken as axiomatic that the business of manufacturing is undertaken with the intention, and in the hope, of making profits; and, so long as they are reasonable profits, this is perfectly right and proper, and tends to the good of the community.

In the years before the war, up to 1911 or 1912, unrestricted competition had existed in the electrical industry, and the state of things brought about by this fact is within the recollection of many, though not, unfortunately, of all. Realising the impossibility of continuing under such conditions, groups of manufacturers began to get together for the purpose of controlling competition, and for many years this work was carried on, preventing further falling away of prices, improving quality, stabilising conditions, and generally tending to the good of the industry and of the public at large. Cynics may smile or mock at the claim that restriction of competition is good for the public, but it is only necessary to ask whether it is better to pay a reasonable price and keep up the quality of the product, or to pay a cut price and let the quality be cut proportionally. Unless manufacturers make profits, not only will quality rapidly deteriorate, but progress and research will become impossible.

Mistakes may have been made in the conduct of some of these groups. Unduly rigid conditions as to prices may, in some cases, tend to arouse opposition and cause dissatisfaction. Attempts to coerce, or at all events to influence, the direction in which an intending customer shall place his orders, have at times caused unpleasantness. On the whole, however, a comparison of the conditions existing, say, in 1908, with those existing in, for example, 1926, is all in favour of the latter.

With the increasing scarcity of home orders, the intensity of competition in the export market, and the increase in the number of manufacturing firms, a change has gradually been brought about. New firms, acquiring some of their staff from those already in the business and knowing the methods of operation of the groups, endeavoured to fix their prices a little below those which they knew would be quoted by the established makers. The established makers, confident that their reputations

would suffice to attract business to them, and reluctant to reduce prices to an unprofitable level, and so to cut the quality of their product, continued on their course.

Endeavours, partially successful, have in some cases been made to attract the newer makers into the existing groups, and consideration has been given to methods of securing a reasonable and equitable distribution of the available business among all participants. The advent of newcomers, however, in some cases brought about a complete change of atmosphere. Incompatibilities were revealed, friction resulted, and in a number of cases disruption occurred.

The inevitable result must be that competition will become more and more intense, prices will drop, and prosperity diminish and disappear, unless something is done to arrest the process. The anticipated period of prosperity, then, may well turn out to be a period of cut-throat warfare, and more harm than good may very easily be accomplished. But it is impossible that the conditions of 1908 should recur, for there is too much at stake in these days. The magnitude and importance of the electrical industry to-day transcends anything that was known twenty years ago; and men who are accustomed to dealing with big things in other industries are now concerned with the electrical world. What, then, will happen?

That remains to be seen, but a tentative forecast may be attempted. Those who have most to lose will probably show a tendency to move closer together. Financial merging may occur in some cases. Others may attempt to secure large blocks of business by quoting very low prices, and trusting to the consequent spreading of overhead charges to bring their costs sufficiently low to enable them to show a profit. If they overshoot the mark, bankruptcy and disappearance will be their fate. After a few years of this, a period of stability may again be reached, with fewer firms in the industry, and in all probability a generally lower level of prosperity. Such appears, to many experienced observers, to be a likely course of events. Already there are indications of the correctness of the view outlined.

Co-operative working is inevitable. It may come by voluntary means, or by compulsion from the financial interests, but it will come. It would be well if men of broad views and statesmanlike vision could be found within the industry who could bring it about without disaster.

The Cable and Wireless Fusion.

Success has attended the efforts of Sir William Plender as representing the cable companies, and of Sir Gilbert Garnsey as representing the Marconi Company, in producing a scheme whereunder co-operation should mark the course of future submarine telegraphic and radio communication, instead of relentless competition. For some time past the air has been full of rumours, and it was satisfactory that it was found possible to make an official announcement toward the end of last week which, so far as the main points are concerned, removed uncertainty. In expressing our editorial comments of December 9th, 1927, entitled "Competition or Co-operation," we held the conviction that there could only be one reasonable issue to the controversy that was then in progress, namely, co-operative action which would allow of the full development of both systems, and the safeguarding of the just claims of the Empire in respect of safe and cheap communication, and that such a task would not be found beyond the powers of our statesmen and business men. The recommendation now put forward by Sir Wm. Plender and Sir Gilbert Garnsey is that a fusion of interests be arranged through the medium of a holding company as detailed in our "City Notes." The arrangement will be dependent on an agreement being made with the British Government and the Governments of the Dominions and India which "will be satisfactory to the cable companies and to the Marconi Company." Particulars of the £53,000,000 capital of the amalgamated or holding company will be found elsewhere. The board will consist of twelve members of the cable companies and eight members of the Marconi Company. The voting power will be: Cables, 56.25 per cent.; Marconi, 43.75 per cent. Of the capital of the holding company, £36,350,000 will be held by the cable companies and £17,350,000 by Marconi's.

The scheme has had a favourable first reception both in the market and in the Press. It has, of course, to pass through various stages before it can become an accomplished fact, but it must constitute some measure of relief all round that so substantial a measure of agreement has been reached in so short a space of time, promising peace and progress in our Empire and world communication.

The E.D.A.

In this issue we report the proceedings at the annual meeting and dinner of the British Electrical Development Association. The report for 1927, which is also reviewed, is not such a good one as we should have liked to see. The expenditure exceeded the income, reducing the balance in hand. It has to be remembered, of course, that campaigns cost money, but surely one of their effects should have been greatly increased revenue. They cannot be considered completely successful unless they touch the pocket of the industry as well as the mind of the public. Sir James Devonshire pointed out that if all the supply undertakings subscribed in the full scale (which is not an exorbitant one), the Association's revenue would be doubled. It will be one of the tasks of Lt.-Col. Vignoles to bring undertakings to a proper sense of their duty (and advantage) in this respect.

References were made both at the meeting and the dinner to the inestimable services of Mr. Beauchamp during his eight years as director and secretary; Lt.-Col. Vignoles will, we feel sure, carry on the good work and lead England toward the all-electric era.

The Central England Electricity Scheme.

The publication of the Central England Electricity Scheme forms one of the principal events of the week, and is all the more important in that this scheme may be regarded as the heart or core of the scheme for an interconnected network of electric power distribution for the whole of the country. An outline of the scheme is given on another page of the present issue, from which it will be seen that it embraces an area of no less than 7,311 square miles—one of the principal industrial districts of the United Kingdom, in which, as against a present annual consumption of 762 million units, it is estimated that 2,820 million units will be required in 1940-41.

Up to the end of 1934-35, the scheme involves a capital outlay of £7,363,079, of which £3,597,679, or nearly half, will be expended on the erection of 369 road miles of 132,000-V overhead cables, and the establishment of nineteen transforming stations. Provision is made at four points for interconnection with the distribution systems of other areas and ultimately of the whole country.

One of the difficult problems the Commissioners have had to deal with has been that of securing a standardisation of the 50-cycle frequency, several of the undertakings in the area being arranged for 25-cycle production. After protracted negotiations, a scheme of working with a gradual change-over to the standard 50-cycle frequency has been arrived at, the cost of the work being estimated at £2,061,400. Commencing with 1929-30, the scheme will, it is anticipated, show an annual surplus until 1934-35, when the new capital charges will involve a deficit decreasing yearly until 1938-39, the project then again entering on a profit-earning era. It has been officially stated that the estimated costs of generation will fall from 0.4291d. to 0.3638d. per unit between 1930-31 and 1934-35, and that as against an average charge of 1.477d. per unit in 1925-26, consumers may look forward to an average of "measurably under 1d. per unit"

Heavy Electric Traction in Italy.

A review of the present position of railway electrification in Italy, and of recent developments in line equipment and rolling stock.

BY THEODORE RICH.

IN matters relating to heavy electric traction, the world owes a great debt to the enterprise of the Italians; they have done a lot of spade work and have not always received the recognition they deserve. It is true that much of the earlier design and construction was based on the genius of the engineering staff of Messrs. Ganz, of Budapest, and that Hungarians like Mr. Kando materially influenced electric locomotive design, but all the same, continuous progress has taken place, which is all the more creditable considering the difficult financial and social conditions that ruled in Italy for a number of years. Few of those who have visited that country recently can have failed to note the extraordinary progress which has taken place regarding railway and general transport since chameleonic professional politicians were replaced by patriotic strong men; but to give credit where it is due, one must not forget that, despite the difficulties inherent in State railway operation under a so-called democratic régime, many of the recent developments have been based on work done and projects made before, during, and shortly after the war. Fig. 2 shows the standard-gauge heavy lines which have been electrified or are in the course of electrification.

Electrification has been continued to the north-west of Genoa and to the south-east, so that now international trains are hauled electrically from Modane to Spezia, Pisa and Leghorn, on the line towards Rome, a distance of about 335 miles; there are also various short sections around Alessandria. A further important section to the south has been completed from Bologna to Florence, the first section across the Apennines having very heavy gradients; a line is under construction between Bologna and Florence, with a long summit tunnel by which the summit level between these points will be greatly lowered.

A section of considerable importance from Bolzano to the Austrian frontier on the Brenner Pass, on the Verona-Innsbruck-Munich through route, is now being electrified; it is 56 miles long, with gradients of 1 in 44, over which heavy international trains are hauled. The 16-17-cycle, three-phase system is being adopted, so that ultimately Milan and Venice will be linked up on the same system.

Further south, the line—108 miles long, with 12 miles of tunnels—from Rome to Sulmona, *via* Tivoli, is being electrified on the 3-phase system at 10,000 volts, 42 cycles, using the standard frequency of the locality; power will be drawn from several alternative sources of supply. From Foggia, on the Adriatic slope, to Benevento, a distance of 63 miles, direct current at 3,000 volts is being used. A suburban section out of Naples to Pozzuoli has been electrified on the third-rail system.

The programme of electrical development in the north includes the connection of Chiasso, on the St. Gothard line, with Milan, and Iselle and Domodossola with Gallarate on the Simplon line, and from Milan to Voghera, thus allowing for electric traction through to Genoa and thence to Leghorn. Before long it will be possible to travel by electrically-hauled trains from Delle and Basle across the Alps to Milan, Genoa, Pisa, and thence to Florence. The average energy purchased or specially generated per ton-mile hauled for purely traction purposes, measured at delivery points, is about 29 watt-hours. The highest consumption, 55 watt-hours, is on the Milan-Varese direct-current section, where acceleration is high, and a material amount of power is used for heating the trains; for example, in July the consumption is 45 watt-hours, and in January it is 78. In Piedmont and on the Italian Riviera the corresponding figure is 32 watt-hours. The average consumption of coal per ton-kilometre on the steam-operated sections

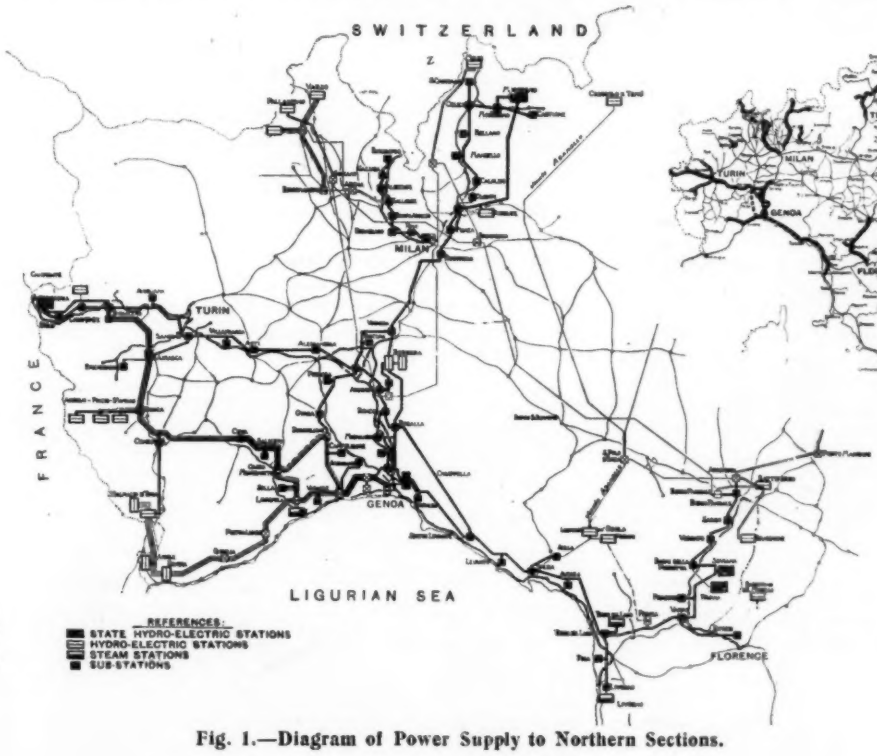


Fig. 1.—Diagram of Power Supply to Northern Sections.

Fig. 2.—Map of Electrified Railways in Italy.

of the Italian State Railways is 58 grams (0.127 lb.). It is estimated that the adoption of electric traction means a reduction of imported coal by nearly 350,000 tons a year.

Power Supply.

When the Giovi section out of Genoa was first electrified, energy was obtained from a steam station close to Genoa containing two 5,000-kW Westinghouse double-flow turbo-generators at 16-17 cycles, 13,000 volts, which

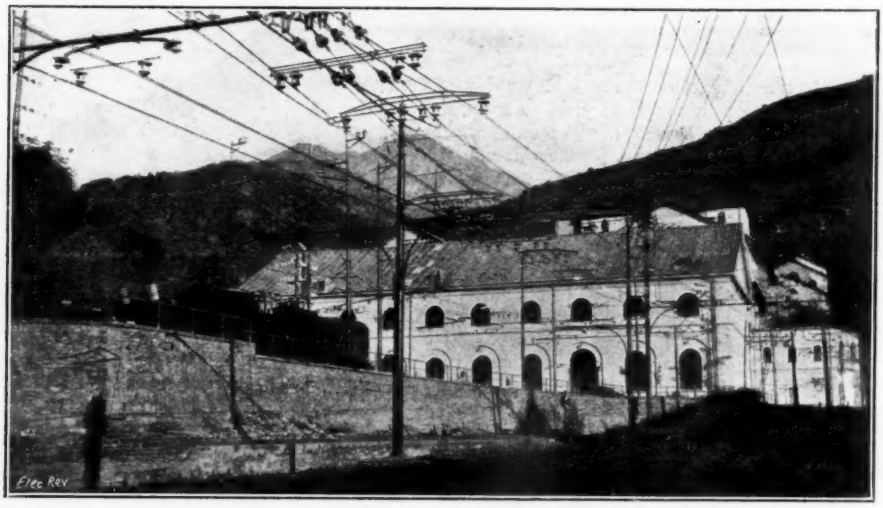


Fig. 3.—Exterior of Bardonecchia Power Station.

Fig. 4.—Transformer Cubicles.

served the section over the ridge by means of four sub-stations; this station has been recently reconstructed and modernised. At Bardonecchia, outside the Mont Cenis

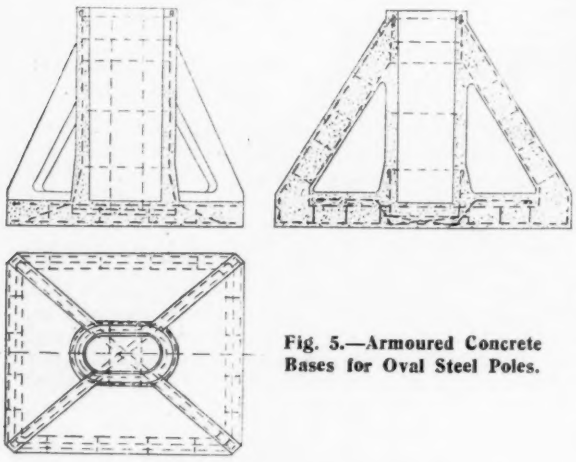


Fig. 5.—Armoured Concrete Bases for Oval Steel Poles.

tunnel, a power station was installed with hydraulic turbine plant operated from two converging mountain valleys. Fig. 3 shows the outside of this station looking towards the tunnel entrance. A portable transformer station can be seen on the left of the view. Fig. 4 shows a new series of transformer cells taken when under construction at the same point. Fig. 1 shows the connected power stations, State and other connecting lines, and sub-stations. Towards Turin electricity is obtained from the municipal central station of that city through frequency - changers from 50 cycles.

Owing to the difficulties due to the absence of native steam coal during the war, it was of great importance, even if not strictly economic, to develop native fuels at all costs, and an important private installation was put up, with the co-operation of the State, at Torre del Lago, near Pisa, to use peat in the main to supply power to the railway. Rapid development is also taking place in the lignite fields not far from Florence. The policy adopted in the North has been to produce part of the power from 16-17-cycle State stations and part from public supply undertakings, either generated at railway frequency or supplied and converted from commercial frequencies; the railway authorities have their own interconnecting network at 16-17 cycles, which links up supply points in the Western Alps with sub-stations along the coast as far as Leghorn, and with the sub-stations which supply the new Bologna-Florence-Pisa line. Some of the lines are operated in

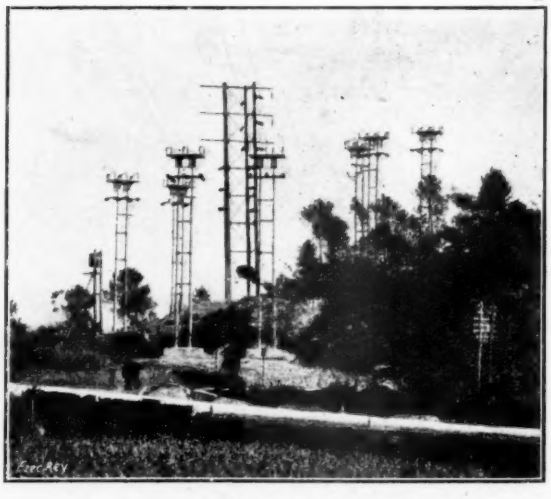


Fig. 6.—Junction Point on 60,000-volt Feeders.

coliaboration with supply authorities, so we find 50-cycle h.p. lines alongside those of 16-17-cycles and 42-cycle plant linked up also through motor generators.

Except where the traffic is very dense and the grades are very heavy on the 16-17 cycle sections, the step-down stations are about 12 miles apart. On the new southern branches at 42 cycles, a distance of about 24 miles is arranged for. The railway interconnecting and feeder mains are at present operated at 60,000 volts. Arrangements are made so that 100 000 volts can be used later when required on the suspension insulator sections. On a number of sections the feeders are carried on each side of the railway track, the trolley lines being carried

by brackets, and the intermediate spans being supported by shorter posts. There are three types of support in use, namely, Mannesmann drawn tubes, oval welded tubes, and lattice supports. The welded and lattice posts are up to 20 metres (65.5 ft.) in length; the former type 21.6 × 8.2 in. at the base, weighs 1¼ tons. Along the railway where the foundations are bad, pre-cast concrete bases are being used. Fig. 5 shows one of these made for oval section welded steel poles. On cross-country lines spans up to 600 metres have been used across some of the gorges. On some sections there are 60,000-volt lines on both sides of the track; both pin and suspension insulators are used. Insulators of the Hewlett type have given good results. The insulators as a rule are of porcelain, although a trial is being made of white glass insulators of the American Pyrex type, made at Acqui, which are said to serve very well for plain vertical suspension insulators.

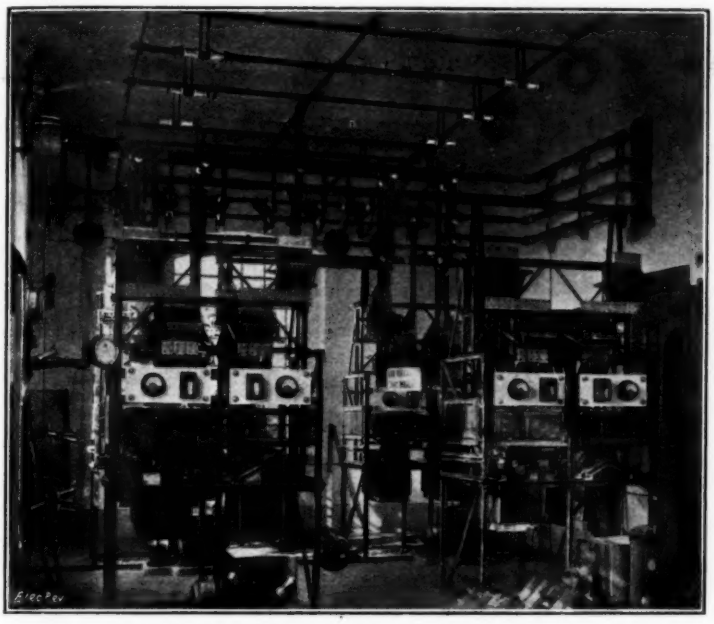


Fig. 7.—Track Switchgear at Torre del Lago.

About 1,400 miles of 16-cycle three-phase transmission mains has been erected specially for railway supply, but in addition to this a material amount of load destined for railway operation is supplied through frequency changers and passes over power companies' mains at commercial frequencies. Some of these lines can be seen in fig. 1. Fig. 6 shows a junction point on the Apennines above Rapallo, where the main feeder from the north links up with sub-station feeders and with a link to the south. It is of interest to note, from the illustration, that the State Post Office department finds that it is possible for its lines to pass under a series of 60-000-volt lines without guards. At Sestri Levante two synchronous condensers have been installed, of 1,550 kVA at 500 r.p.m.; these are arranged to pump into the system through special connections on the transformers, which also feed the line. An interesting piece of work is to be seen near Torre del Lago, where the h.p. line crosses the lake; the line is on trellis towers, the foundations being on four concrete piles; the span is 350 metres, and each foundation costs about 50,000 lire.

Communication is being made between some of the chief sub-station points on the 60,000-volt, three-phase lines by the use of high-frequency telephones with 200 metres of guide line under the main line; the system used is that of Arturo Pérégo, of Milan.

Between sub-stations on the Riviera lines a step-by-step selective single-line system of telephones is used, the construction being one developed by the Western Electric Co. The sub-stations are arranged in neat buildings; as a rule single-phase transformers are adopted. Fig. 7 shows the 3,500-4,000-volt switchgear at Torre del Lago;

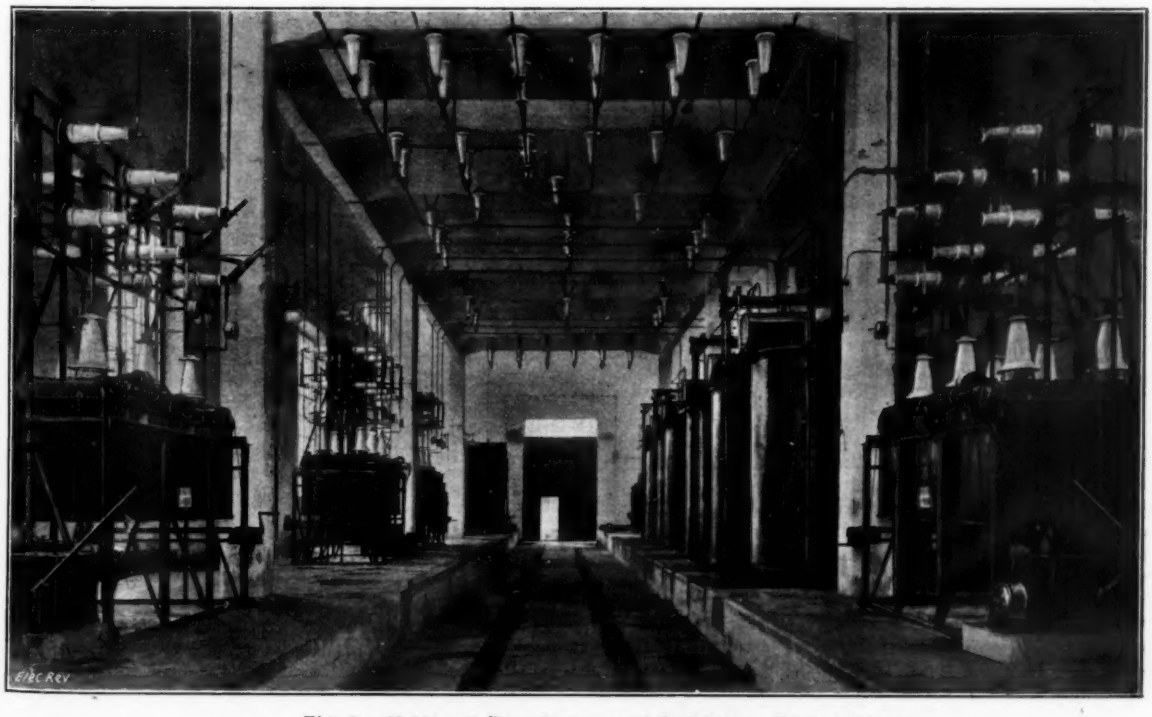


Fig. 8.—60,000-volt Transformers and Switchgear, Torre del Lago.

the motors for operating the switchgear through trips can be seen on the floor. Fig. 8 shows the 60,000-volt

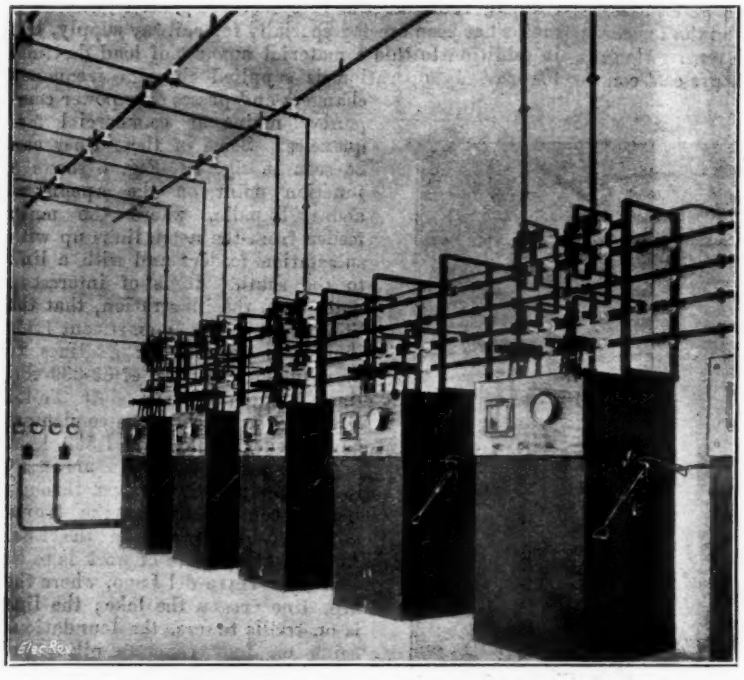


Fig. 9.—Track Switchgear near Leghorn.

side of the step-up and sub-station at the same point. Fig. 9 represents 3,500-4,000-volt switchgear in a new sub-station at Viareggio, near Leghorn; the building is mainly of armoured concrete.

Track Equipment.

At first sight one would think that the use of two trolley wires would lead to a lot of difficulty, especially at switches and crossings; as a matter of fact, this has not proved to be the case, and almost anything which can be done with a third-rail system can also be done with the three-phase system. In the cases, however, of little-used cross-over roads, the locomotive trolleys are lowered at the moment of passing from one track to the other. On some of the newer sections, to make the signals easier to pick out, diagonal black and white stripes are painted on the steel supports. Each locomotive has two sets of contact bows which, unlike those on the single-phase section of the Southern Railway, will work in both directions. The arms are long, and the bows lie close to the buffers so that there is a material distance between them; by this means one trolley tends to bridge gaps for the other.

The two aerial conductors are normally placed 960 mm. (3 ft. $1\frac{3}{4}$ in.) apart and normally 5.5 metres (18 ft.) from the rails. In the normal sections the insulation is double; on some of the newest catenary sections single insulation has been found sufficient.

(To be continued.)

Electricity Distribution.

An analysis of the various conditions which determine the efficiency of a bulk-supply electricity undertaking, and their bearing on the design, construction and operation of the system.

By C. G. WATSON, M.I.E.E.

THE bulk supply of electric energy, with its definite charges for maximum demand and for units consumed, makes the efficiency of the distribution system a factor of supreme importance to the success of an undertaking. Already there are a number of distributing authorities taking a h.p. supply in bulk and transforming down on the spot or at a distant sub-station for distribution to consumers, and there will be a far greater number of such authorities in the future. Therefore it is becoming increasingly important that an analysis should be made of the factors entering into the cost of distribution under the conditions of bulk supply, so that the incidence of the charges may be taken into account during the design, construction, and operation of a system. It is the purpose of this article briefly to make such an analysis.

The efficiency of a distribution system may be valued in different ways. Thus, it may be valued as electrical efficiency, as loading efficiency, as system efficiency, as economic efficiency, as commercial efficiency, and in other ways as varied as the comparisons to be made. Here I shall discuss the efficiencies of importance to the economic engineer

The electrical efficiency is the ratio of the number of units delivered to the consumers to the number of units received at the terminal point of the bulk supply. The units received equal the units delivered plus distribution losses; these may be split into mains and sub-station losses.

Consider first the mains loss: neglecting here, as throughout, inappreciable quantities, and taking a system having an inherent mains regulation of d per cent. (that is to say, having a drop of voltage from full load to no load between main switchboard maintained at constant potential, and consumer, of d per cent. with load of unity power factor, which drop may be partly on the h.p. side and partly on the l.p. side), the rate of loss in units at maximum load will be

$$u_b/f \times 8760 \times 1/\phi^2 \times d/100 \quad \ldots\ldots(1)$$

where u_b = number of units received in bulk during one year,

f = system load factor in terms of unity,

and ϕ = power factor of system.

Over a whole year, the total mains loss will be the rate of maximum loss multiplied by the ratio of the mean square load to the square of the maximum load (the ratio is the load factor of the loss) multiplied by the number of hours in one year. That is

$$u_b/f \times 8760 \times 1/\phi^2 \times d/100 \times (f+f^2)/2 \times 8760 \quad \ldots\ldots(2)$$

which may be usefully condensed to

$$u_b dr/100 \quad \ldots\ldots(2a)$$

where $r = (f+f^2)/2f\phi^2$ ..... (3)

A refinement would be to allow for the loss in boosting, but as this is a relatively small amount, it suffices here for this loss to be mentioned.

Now the sub-station loss: This will depend on whether or not means are used to switch the transformers in and out as the load fluctuates. First, take the case of a sub-station where such means are used (hereafter called an attended sub-station). In this case the load factor will have little effect on the electrical efficiency of the sub-station, and so will be neglected, but the power factor has to be taken into account. To do this, the losses may be considered as being divided between the iron and copper of transformers, switchgear and connections. The iron loss, in what follows, will be taken as 1 per cent. of the load at any power factor, and the copper loss as 1½ per cent., but at unity power factor only. At other power factors, it will be $1.5/\phi^2$ per cent. Taking the year round, the total sub-station loss will be

$$U_b(1+1.5/\phi^2)/100 \quad \ldots\ldots(4)$$

In the case of a sub-station having transformers permanently in circuit (hereafter called an unattended sub-station), the loss will vary with the load factor as well as with the power factor. Again, dividing the loss between iron and copper, and assuming that transformer capacity is equal to maximum load, the iron loss will equal 1 per cent. of the maximum load throughout the year. The copper loss will be at the rate of 1½ per cent. at maximum load and unity power factor, and the yearly loss can be obtained by using a factor similar to that used in calculating the mains loss. So, the yearly loss in the case of an unattended sub-station is

$$U_b(1/f+1.5r)/100 \quad \ldots\ldots(5)$$

Combining the above results, the percentage electrical efficiency E_E of a system is, in the case of an attended sub-station,

$$100-dr-(1+1.5)/\phi^2 \quad \ldots\ldots(6)$$

and

$$100-(r(d+1.5)+1/f) \quad \ldots\ldots(7)$$

in the case of an unattended sub-station.

Loading efficiency: This is a comparison of the ideal with the real. That is to say, it is the relation between the cost of the total number of units under the assumed condition of unity load factor and the cost under actual conditions. It is given by

$$E_L=(a+36.5b)f/(a+36.5b\ f) \quad \ldots\ldots(8)$$

where E_L is the loading efficiency, a is the charge per kW of maximum demand per year in pounds, and b is the charge per unit in pence. The mathematically minded will gather from the formula that the result depends on the ratio of the two items of energy charge and on the load factor, and that the smaller the ratio a/b, the higher will be the efficiency at any one load factor.

Here we may define the ideal cost per unit c_o as

$$£a/8760+b/240, \text{ or } £(.0274a+b)/240 \quad \ldots\ldots(9)$$

Then the actual cost per unit received $c_a=c_o/E_L$ (10)

System efficiency: This is the product of the electrical and loading efficiencies, or $E_S=E_E\times E_L$ .....(11)

So the energy cost per unit delivered to consumer

$$c_s=c_o/E_S \quad \ldots\ldots(12)$$

The economic efficiency E_C or the ratio of the ideal cost of all energy sold to the actual cost is

$$U_S C_o/(U_b C_a+O+P) \quad \ldots\ldots(13)$$

U_S being the number of units sold, O the labour and incidental costs of operating and maintaining the system, and P the capital charges, that is, interest, depreciation, and management expenses chargeable to capital. So the total cost per unit sold is

$$C_o/E_c \quad \ldots\ldots(14)$$

From what has hitherto appeared herein, it will be seen that the greatest benefit to the economic efficiency of a system is a high load factor. Compared with that, other factors, assuming reasonable modernity of plant, have but a minor effect. That fact is generally recognised. It is generally recognised, too, that a high power factor is desirable, although its effect, when the regulation is low, is small; but it is not generally recognised that a low mains regulation is also of real importance, and that, when it is high, its improvement deserves careful consideration. One effect of the mains loss is the lowering of the system load factor, and this effect is more noticeable as the regulation increases. A point worthy of note is that, except in cases of large capacities and low load factors, the higher electrical efficiency of attended, as compared with unattended sub-stations, is not enough to pay for the cost of attendance.

As an example of the efficiencies so far discussed, take the case of an undertaking distributing sixteen million units a year and having one main control station and four sub-stations. In the accompanying table the figures in column A are for the state of affairs when the construction has been dictated by commercial reasons, that is, it has been done as cheaply as possible; the load factor is 25 per cent., and the sub-stations are attended. Column B shows the state after an additional 25 per cent. has been spent by way of improving the regulation. Column C shows the effect of the expenditure of an extra 5 per cent. by way of improved workmanship. (Note well that the case for good workmanship does not mainly rest on such figures as these.) Column D shows the effect of an improved power factor. Column E the state when the sub-stations become unattended. Column F the effect of an improved load factor, and Column G the effect of increased load.

The remaining efficiency specified earlier in this article is the commercial efficiency, or the ratio of receipts to costs. This involves selling prices and other factors not commonly allowed to be within the province of an engineer. So, except to remark that it is of more interest to the financier and to the sociologist than to the engineer, as such; and that in so far as the ratio is less than 1, it is indicative either of bad management or of public spirit, and that in so far as it exceeds 1, it is a measure of the greediness of the investor or of the instability of the concern, I say no more.

	A	B	C	D	E	F	G
Millions of units bought	20·74	17·46	...	17·17	17·52	17·3	21·82
System load factor	·25	·285	...	...	...	·35	...
„ power „	·8	...	...	·9	...	...	...
Mains regulation, %	20	5	...	...	...	4	5
„ loss (10^6 units)	4·05	·88	...	·68	·69	·59	·93
Substation „ „	·69	·58	...	·49	·83	·71	·89
Electrical efficiency, %	77·1	91·6	...	93·2	91.3	92·5	91·6
Charge per kW of max. demand	£5	...	...	...	...	...	...
„ „ unit	·3d.	...	...	...	...	...	...
Loading efficiency	51 5	56	...	...	...	63 2	...
Ideal cost per unit	·437d.	...	...	...	...	...	...
Actual cost per unit bought	·85d.	·78d.	...	...		·692d.	...
System efficiency, %	59·7	51·3	...	52·2	51·1	58 5	57·9
Energy cost per unit sold	1·1d.	·85d.	...	·84d.	·85d.	·747d.	·754d.
Number of units sold (10^6)	16	...	...	...	...	...	20
Operation charges	£13,200	...	£9,900	...	£6,600	...	...
Capital „ at 8%	£24.000	£30,000	£31,500	...	...	...	...
Economic efficiency, %	26·3	29·1	29·7	30	30·6	33·1	36·1
Total cost per unit sold	1·66d.	1·5d.	1·47d.	1·46d.	1·43d.	1·32d.	1·31d.

Domestic Water Heating.

The Author shows that the Thermal Storage System is a necessity for Electric Load Development.

By R. J. HEBBERT.

A PEEP into the future of public electricity supply indicates that the time is not far distant when the demand for domestic purposes will be vastly greater than that for industry and commerce. With supplies of electricity available to every house at economic tariffs, the possibilities of domestic load development will be almost beyond conception. But it needs only a glance at the present-day load-distribution curves for any residential area to show that the only hope of taking full advantage of this future domestic demand lies in the intensive development of such loads as may be confined to the valleys of the existing load curves, and thus serve to raise the load factor of operation for the supply system.

Dr. Ferranti has said that, in his opinion, the whole future of electrical development depends on storage, and it is certain that an economical means of storing energy, during those hours of the day in which the supply stations are at present running on light load, is what is most needed for making the complete electrification of the homes of the people a commercial possibility. In the course of time some truly efficient means of storing electricity will, no doubt, be discovered, but meanwhile, if we cannot satisfactorily store electricity, we can most efficiently and economically store its energy product in the form of heat. It is fortunate that so large a proportion of the energy required to run a household is in the form of low-grade heat in water, for this is energy in the one form which lends itself most conveniently to economic storage, and the electric thermal-storage water heater thus presents the attractive possibility of an efficient energy accumulator for installation on the premises of every electrical consumer.

Mention of domestic water heating as a load of potentially great importance to the electricity supply authorities often awakens controversy centring upon a comparison between the cost of electricity and the cost of fuels such as coke, gas, &c., commonly used for the purpose. To electricity, however, must be credited the saving of the entire cost of all labour, and, by the elimination of all such losses as are inseparably connected with flues and circulating pipes between the boiler and the storage tank, it enables the actual heat units generated to be utilised with efficiency far higher than is possible by any other means. Moreover, we should not lose sight of the fact that the use of coke, which is generally put forward as the cheapest means of providing hot water for the household, entails the expenditure of a fixed sum per day, in that the boiler must be kept fired all the time, whereas the cost of using electricity is a definite sum per gallon of water used at a given temperature, a consideration which lends itself to the practice of very useful economies.

The fact is that there exists to-day a large and rapidly increasing market for the sale of electricity for heating water, and it rests with the supply engineer to develop this market on lines which ensure that every unit of energy sold for water heating will contribute to the improvement of the load factor of the supply system. The prominence that has lately been given to this subject of electric water heating presents in itself a danger that supply authorities may lose some of the great advantage of this form of additional load unless they make special efforts to control its development on the right lines.

Manufacturers have placed on the market many devices for the electric heating of water. The immersion heater for introduction into the existing storage tank affords a ready and inexpensive means of supplementing electrically the heat given to the water by the kitchen fire, but is apt to be wasteful in operation on account of the difficulty which is found in providing truly effective lagging to prevent radiation losses. It is also generally unsatisfactory when called upon to work independently of the fire, because there is no means of preventing the incoming cold water, when hot water is being drawn off, from mixing with and cooling the hot water that is stored. The circulator, another means of applying electric heat to the existing storage cylinder, is open to much the same criticism as the immersion heater. The electric belt is a still simpler and less expensive means of providing supplementary heat for an existing system, but it presents the same difficulties of lagging, and there is a considerable loss by reason of the relatively low efficiency with which the heat is transferred from the electric element to the water in the tank.

The electric geyser presents a highly efficient means of heating water, and can be installed at low cost, but its necessarily high loading puts it out of consideration except for hand basins and such purposes for which only small quantities of water are required. The curves in fig. 1 show the rate at which water can be

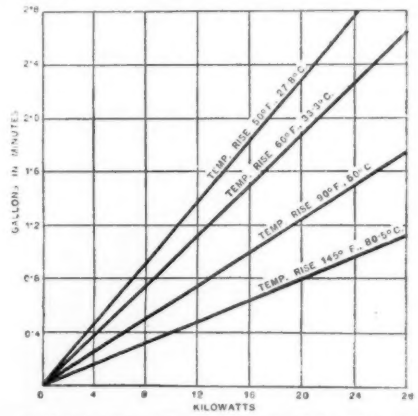


Fig. 1.—Rate-Loading Curves for Electric Water Heating.

raised through certain degrees of temperature with various loadings of electric heating elements. In calculating the figures, heat losses of all kinds have been neglected, the efficiency thus being taken as 100 per cent.

For baths and lavatory basins water is needed at a temperature of about 110 deg. F. (43.4 deg. C.), which is equivalent to an average temperature rise of 60 deg. F. (33.3 deg. C.). Reference to the appropriate curve will show that a geyser capable of furnishing a bath of 18 to 20 gallons in 10 minutes would need to be rated at not less than 20 kW.

For furnishing local supplies of hot water to baths, hand basins, and other points throughout the house, there are available many small equipments well designed on lines similar to those underlying the thermal-storage principle. All of these devices present attractions of one kind or another to the progressive electrical consumer. None of them are costly to buy, and they are consequently being connected to the mains in increasingly large numbers. From the supply engineer's point of view, however, they are all open to the same serious objection that, as current-consuming rather than energy-storage devices, the additional load which they represent is liable to result in an increased peak demand on the system, instead of being confined, as water-heating load can be, to the valleys of the present load curve.

The thermal-storage system of water heating is the only one capable of combining entirely satisfactory

service to the consumer with the loading characteristics most desired by the supply engineer. Under a suitable system of automatic control it affords to the supply authority, not merely a big additional load, but one confined to the hours of the day during which it can be supplied at the lowest cost. The requirements, then, are:—

(1) A thoroughly well-lagged container of capacity sufficient to ensure adequate storage of hot water to meet any demand that may arise during the peak hours of the electric supply system when the water heater is automatically switched out of circuit.

(2) Suitable provision to ensure that water from the cold supply shall not mix with the hot water in the storage tank.

(3) Thermostatically-controlled heating elements of rating dependent upon the capacity of the water container and the daily hours of loading determined by the electric supply authority.

(4) An automatic system of control to restrict the electricity supply for the equipment to the off-peak hours of the system.

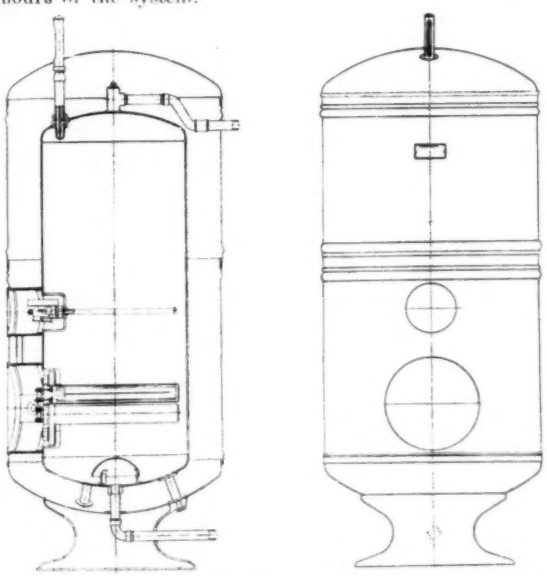


Fig. 2.—Construction of Cylindrical Water Heater.

Fig. 2 shows the construction of a cylindrical water heater designed to meet these requirements. It is lagged with four inches of a specially selected quality of packed granular cork screened to about the size of a split pea. This heat insulation enables a 40-gallon container full of water at a temperature of 194 deg. F. (90 deg. C.) with surrounding air at 50 deg. F. (10 deg. C.) to be stored with a heat loss of only 4.55 B.th.u. per minute. The electrical equivalent of this is 80 watts. Thus a temperature of 194 deg. F. (90 deg. C.) can be maintained in 40 gallons of water with a consumption of less than 2 kWh per day.

In this equipment mixing of the hot and cold water is prevented by means of a dome-shaped baffle over the cold-water inlet, which so diffuses the current of cold water as to provide a gradual upward displacement of the hot water drawn off. Any effect of stirring being thus avoided, the low heat conductivity of water ensures that the temperature of the hot water already in store is practically unaffected by the incoming cold water.

The storage cylinder is provided with pockets for the thermostat and the heating elements, so that these can be withdrawn for examination without disturbing the water. The pockets for the heating elements are conveniently mounted on a large hand-hole plate which, after drawing off the water, can be removed for the purpose of cleaning the tank and removing any scale that may have been deposited.

The thermostat depends for its operation on the difference between the heat expansion coefficients of two metals. A rod of "invar" metal with a very low coefficient of expansion is centred in and securely pinned to one end of a length of brass tube, the other end of which is fixed to a frame. Through this frame the free end of the "invar" rod passes to an ingeniously simple system of levers connected to a gasfilled mercury switch. In this way the expansion of the brass tube under the influence of heat is amplified sufficiently to tilt the mercury switch and thus open the circuit of the heating element. Variable setting as to the temperature of operation is provided by means of a graduated micrometer adjustment on the first lever. The heating elements, to be assured of a satisfactorily long life, should be rated to run at a temperature not exceeding 450 deg. C. A thermometer should be included in the equipment to indicate the temperature of the storage water.

Fig. 3 shows the results of tests on a 40-gallon heater of this type. By curve No. 1 it will be seen that the 40 gallons of water was raised from 9.5 deg. C.

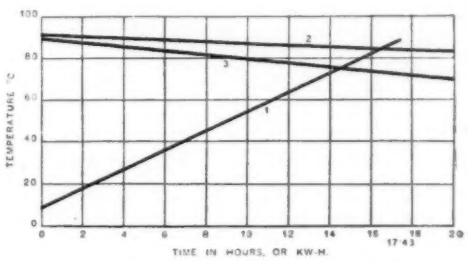


Fig. 3.—Test Results on 40-gal. Heater.

(49.1 deg. F.) to 90 deg. C. (194 deg. F.), with an expenditure of 17.43 kWh. The maximum temperature of the water, attained a short time after the tripping of the thermostat, was 91 deg. C. (195.5 deg. F.), and reference to curve No. 2 will show that from this temperature the loss due to radiation during a period of 20 hours caused a fall in temperature of only 7.5 deg. C. (13.5 deg. F.).

Curve No. 3 shows the result of a test as to the effectiveness of the means provided to prevent mixing of hot and cold water. For this test, after raising the full contents of the tank to a temperature of 90 deg. C. (194 deg. F.), the heating elements were disconnected and 20 gallons of water was drawn off and replaced with the same quantity of cold water at a temperature of 9.5 deg. C. (49.1 deg. F.). The cooling curve then taken shows that after 20 hours, without any further application of heat and with the tank half full of cold water, the storage water was still available for use at a temperature of 70 deg. C. (158 deg. F.)—well above scalding point.

It has often been suggested that, by reason of domestic habits in regard to the hours of the day in which large quantities of hot water are generally required, water heating equipment without any special system of control represents a natural off-peak load; and figures obtained as a result of careful observations in certain districts do, in some degree, confirm this view. Nevertheless, it is felt to be of paramount importance that this load should wholly contribute towards the improvement of the load factor on the system, and that for this purpose it is essential that the load should be subjected to some suitable system of automatic control.

The system most commonly used hitherto has been one employing a time switch to disconnect the supply during certain definite hours of the day. Provided that reliable self-winding time switches are used, the system is a good one with much to recommend it, but unfortunately a good time switch is a costly piece of apparatus. If, instead of aiming directly at levelling up the load curve for the whole of the supply system, we aim first at levelling up the load curve of each individual consumer, the ultimate net result should be the same. Approaching the problem from this point of view, it has become a common practice in America to connect the water heater and the cooker on opposite sides of a

double-throw switch, so that the supply is available to the water heater only when the cooker is not in use.

Proceeding further on the same lines, Messrs. Ferranti, Ltd., have developed the load leveller, an extremely simple automatic device for the control of a water heater on lines which ensure that it shall be utilised with maximum effect in levelling up the individual consumer's load curve. Fig. 4 shows diagram-

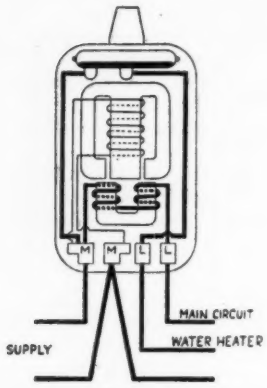


Fig. 4.—Load Leveller.

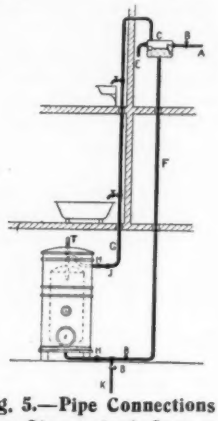


Fig. 5.—Pipe Connections for Storage-tank System.

matically the principle of one of these instruments suitable for an alternating-current system. It consists of an induction relay connected in the household main circuit and mechanically coupled to a gas-filled mercury switch so that when the demand on the household main circuit reaches a predetermined maximum, the relay operates and disconnects the water heater by tripping the mercury switch.

In fig. 6 an attempt has been made to illustrate the effect of a large number of water heaters under this system of control upon the load curve of, say, a substation in a residential area supplying purely domestic load. The diagram (A) suggests that the development of a large water heating load without any special system of control might result in peaks of considerably increased magnitude, whilst the lower diagram (B) shows what might be expected as the ultimate shape of the

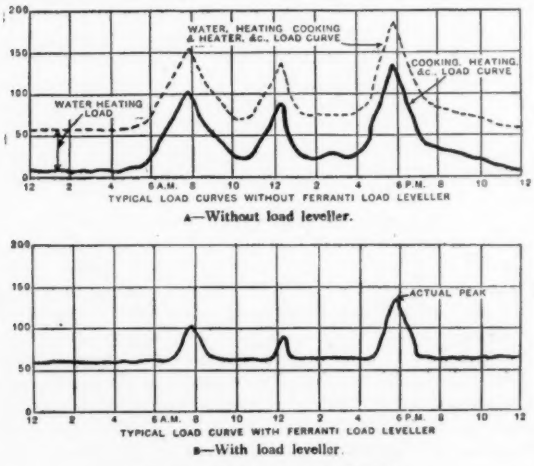

WATER, HEATING, COOKING & HEATER, &c., LOAD CURVE
COOKING, HEATING, &c., LOAD CURVE
WATER HEATING LOAD
TYPICAL LOAD CURVES WITHOUT FERRANTI LOAD LEVELLER
A—Without load leveller.
ACTUAL PEAK
TYPICAL LOAD CURVE WITH FERRANTI LOAD LEVELLER
B—With load leveller.

Fig. 6.—Typical Load Curves.

curve resulting from the development of the same load due to water heaters under the control of load levellers. As the system peaks due to general load commence to build up, the water heaters one by one are disconnected and this thermal-storage load is thus correctly confined to the valleys of the curve, and does not occasion an increase in any of the peaks.

Let us now review the commercial possibilities of developing the domestic water-heating load. Looking at the general load curve for lighting, heating, cooking, &c., represented by the full line in diagram (A) of fig. 6, we may take it that the income derived from this load covers all charges on the capital involved in the generation and distribution system, and that to existing consumers any such additional load as may be definitely confined to the valleys of the curve can be supplied without any increase in capital expenditure. It is obvious, therefore, that in order to encourage the very desirable form of load which the thermal-storage water heater represents, it is an economic proposition to offer some material inducement to consumers to take it. The natural suggestion is a specially low tariff. A view frequently expressed is that this form of load can be profitably supplied at any tariff which includes a unit charge sufficient to cover the bare material cost of generation (fuel and sundries). This view, coupled with the desire to present favourable figures as to the cost of electricity for water heating for comparison with the costs of other methods, has led certain authorities to offer extremely low tariffs. Experience would suggest, however, that the offer of a low tariff is not in itself sufficient. It is noteworthy that the areas in which this load has been most successfully encouraged are those in which the apparatus is offered on hiring terms, and it would appear that the principal difficulty of the average consumer is perhaps less the cost of running the equipment than the capital cost of its installation. The practice of hiring cookers and certain other domestic appliances is now almost general and, for equipment which, like the thermal-storage heater, lends itself to the develop-

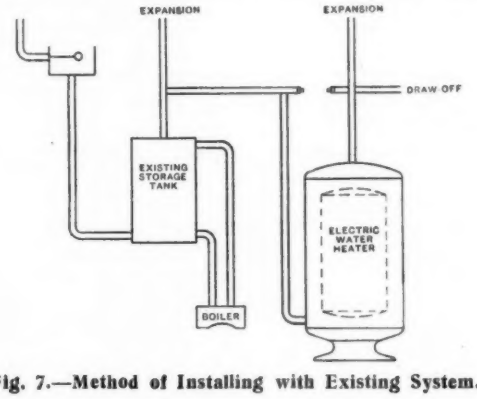


Fig. 7.—Method of Installing with Existing System.

ment of load so much more profitable, it is practical economy to offer the consumer similar terms framed on a more favourable basis. The suggestion therefore is that, having decided upon the economic unit charge, the inducement which can be afforded to the consumer to take this load should be offered, partially at least, in some form of assistance with the capital cost of installation, and probably this can most generally be done by framing really attractive terms of hire for the equipment.

As to the size of the storage tank required for a given size of house, the different habits of different people in regard to the use of hot water make it impossible to lay down any hard and fast rules. A wise rule is to err on the side of liberality and generally to put in as large a tank as can be readily accommodated. A convenient minimum standard size is 20 gallons, and this will be found generally sufficient for small houses of, say, three bedrooms, whilst standard tanks of 40 and 60 gallons capacity are likely to be in common demand for houses of proportionately larger size.

In planning the installation of the equipment in an existing house, it is sometimes not easy to find the necessary space for its accommodation, but a useful feature of the electric storage tank is that, unlike the tank of a fire-heated system, its location is not limited by any need for thermo-siphon circulation of the water, and it can thus often be conveniently accommodated in a basement or cellar. If the consumer is willing to use electricity as the sole means of water heating, the existing storage tank may be removed and the electrical equipment installed in its place. The pipe connections are shown in fig. 5, and this is usually the best arrange-

ment. It is often found, however, that the consumer wishes to retain his kitchen fire and to have electricity available for water heating as a supplementary and alternative means. In this case, an extremely satisfactory and economical system of installation is that shown in fig. 7. The full contents of the electric heater will always be in store at a high temperature. The electricity used under the automatic control of the thermostat will be negligibly small so long as the fire is in use, whilst, during those times when the fire is allowed to go out, the electric heater alone will furnish all the hot water that may be required.

Correctly installed, the electric thermal storage water heater has a remarkably high efficiency. To minimise loss of heat from the draw-off pipes, it is important that these should be kept as short as possible and, with the object of preventing loss by conduction from the storage tank, it is advisable that the main hot pipe should be well lagged for a length of about three feet. The thermostat should be set to operate at a high temperature, and the figure generally recommended is about 90 deg. C. (194 deg. F.). In case, however, of trouble with scale from water containing a high degree of temporary hardness, there may be some advantage gained by the use of a lower setting. For this purpose it will probably be found that a temperature of 75 deg. C (167 deg. F.) is below that at which most of the scale is deposited, and it is sufficiently above the scalding point to ensure that the water is not wastefully used by washing hands under the running tap. In this case it must not be overlooked that the adoption of this temperature setting as against 90 deg. C. reduces the storage capacity of the tank by nearly 20 per cent., and may thus necessitate the use of an equipment of larger size.

In these pages an attempt has been made to present a case for adoption of the electric thermal-storage water heater as a pivot on which to centre the future development of domestic electrification. Regarded merely as a source of additional load, its potential revenue is probably greater than that of any other individual kind of load that can be encouraged, but, of the attractive characteristics of the load, it is not too much to say that only by their exploitation can the present prospects of domestic electrical development be fully materialised.

Coupons in Trade Advertisements.

Their Value as a "Draw" and as a Check.

By J. S. S.

THE value of the use of the coupon in advertisements is being constantly debated wherever advertising men meet. Few will deny that it has its uses but by some the advantages are considered to be outweighed by the disadvantages. The chief, perhaps the only, important disadvantage, is that an invitation in an advertisement to write for a free sample or a catalogue always draws replies from people who are attracted by the offer of something for nothing, but have no intention of doing business with the advertiser. This disadvantage hardly occurs in engineering advertising. All regular readers of technical journals are interested in the industry, and although they may not be in a position to influence the placing of orders now, they may be in the not-far-distant future. If a firm declines to send catalogues when immediate business is impossible, the young engineer may form an unfavourable opinion of the advertiser which will linger for years. Further, engineers are hardly likely to write for catalogues which do not interest them in some way, since they have little enough time for the study of their own branch of engineering and do not belong to the class which feels no compunction in writing for an expensive publication and throwing it away on receipt. Every applicant, then, should be treated as a potential customer.

The distribution of engineering publicity matter can be well carried out on the coupon system as a supplement to the regular mailing list, and will result in less waste than in mailing with the aid of an ordinary trade directory. Coupons are also of great value in checking and compiling mailing lists, and selected lists of engineers interested in different classes of goods can be formed.

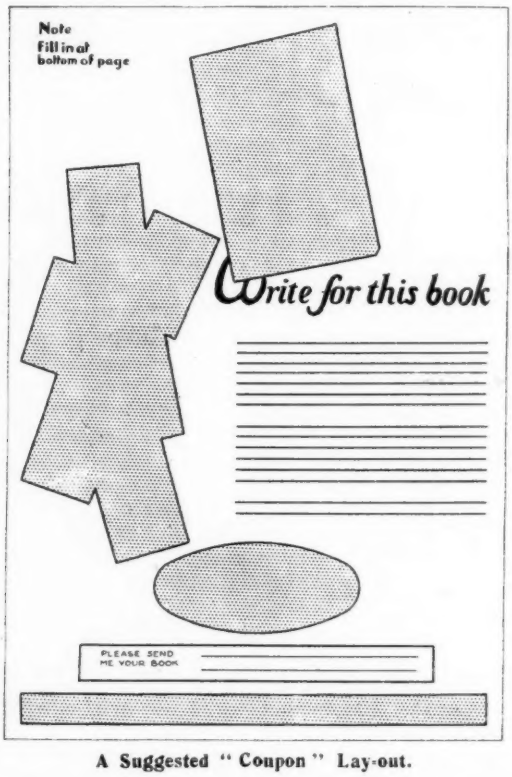
The direct advantages of using a coupon in an advertisement where it is possible are many, both to the sales manager and to the advertisement manager. In the first place a coupon induces action. It helps to make a reader do something, and in doing something, however simple, the name and business of the advertiser are impressed on the memory more firmly than if the advertisement had been merely read and passed over. A coupon gives a climax to the "copy." The latter may arouse interest in the article advertised, but the coupon gives just the necessary additional force to the advertisement to make the reader send for the catalogue if he is at all interested. The writer recently applied for particulars of a small office appliance in response to an invitation to "Fill in the Coupon." The advertisement was not particularly good, and the "copy" alone would not have induced action, but the combination of copy and coupon was effective.

Having received a coupon, the advertiser can set his sales machinery to work. The catalogue is sent out with a letter, and in a few days the local representative follows up with a personal call. Perhaps he would not have been seen by the prospect but for this excuse, or would not have been able to get into touch with the right individual, but the "contact" established by the receipt of the coupon and the despatch of the catalogue paves the way. Even if the catalogue is wasted, the representative has an opportunity of finding out what may interest the firm or individual and of putting their name on the appropriate mailing lists.

But it is to the advertisement manager that coupons are of most value. Within reasonable limits the coupon can prove the effectiveness of an advertisement in comparison with that of another occupying similar space in the same medium or in one of similar value. A large advertiser about to launch an extensive publicity campaign could not decide on the relative merits of different styles of advertisements. The difficulty was solved by putting one advertisement of each style in different media of which the relative pulling powers were known with fair accuracy, attaching a coupon to each advertisement, and analysing the replies. In this way the most effective style of advertisement was determined and was used for a national campaign.

The coupon also assists in the determination of the relative value of different media. It is often very difficult for national advertisers to decide on the best medium for a particular product, and this applies equally to engineering goods. It is obvious that one would not advertise vacuum cleaners in, say, the *Post Office Engineers' Journal*, but mistakes almost as wasteful are constantly being made. By inserting similar advertisements, each with a keyed coupon, in a number of journals simultaneously, the number of replies from each can be ascertained and the cost per reply calculated. It will probably be found that one medium is excellent for mains and distribution supplies but almost useless for power station sundries; another may reach

the contractor but miss the factor. The intelligent advertiser will soon learn that it pays to discriminate in the choice of media for different classes of engineering products, and even journals which one might suppose to be read by almost all engineers can show very indifferent results for certain classes of goods. Perhaps some technical journals are glanced at by a very large number of engineers, but the engineer's *particular* journal is studied and digested. One medium may not be very good for the home market, but may bring inquiries from overseas; another may be effective in Scotland but not so much so in the Home Counties. After a time the advertising man who consistently uses the coupon can decide with very fair accuracy how to spend his appropriation to the best advantage, even though he may have to advertise a wide range of products. He knows how to reach contractors and station engineers; how to get at the chief or the mains engineer; how to bring his product before factory buyers or maintenance men. It is



A Suggested "Coupon" Lay-out.

very difficult to trace sales from engineering advertising —one never gets an order reading "With reference to your advertisement, please send one 5,000-kW alternator"—and any little help the coupon can render in determining the relative value of different advertisements and media is very useful.

Curious little sidelights on human nature are revealed by the use of the coupon. In daily Press advertising it is found that more replies are received if the coupon is at a corner so that it can be cut out easily, than if it is in the middle of the advertisement and has to be cut round with scissors. At least one advertiser in the technical Press invites readers to fill in the dotted line and return the whole page—and then finds that they will go to the trouble of cutting around the dotted lines and send in a neat section of the advertisement, or will scorn the coupon and write a letter.

A layout for a typical advertisement embodying a coupon is reproduced above. In the "copy," readers are invited to fill in the coupon and send in the page. The illustration of the book, the note in the top corner, and the coupon all induce action.

Perhaps the most potent force of the coupon is the establishment of the "life" of an advertisement. Weeks, sometimes months, after an advertisement has appeared, inquiries come in by coupon.

Reviews.

The Performance and Design of Direct-Current Machines. By A. E. Clayton, D.Sc. Pp. xii+418; figs. 261. London: Sir I. Pitman & Sons, Ltd. Price 16s. net.

Despite the number of books on this subject, this present addition is in no way superfluous. Its justification lies in its general excellence and in its up-to-date treatment. The book is intended primarily for students following college courses in electrical engineering. The start off is good. The reader at once gets to grips with the induced e.m.f. and the force on a conductor carrying current in a magnetic field, which lead to the power developed in an armature as the product of the total magnetic and electric loadings and the speed. Pole fringing and effective air gap form valuable parts of the discussion on the magnetic circuit. Windings are dealt with in a straightforward manner, and the reader is not left in doubt as to what are practical cases. The author finds it sufficient to define a winding simply in terms of the number of circuits it contains, and avoids the term "re-entrant." We wish he had been equally courageous in abhorring the terms "duplex" and "multiplex." We do not quite follow him in his argument on symmetrical windings when he says that for larger numbers of poles (12, 16, &c.) no simple generalisation is possible. Has not this matter been examined fairly exhaustively by S. P. Smith in an I.E.E. paper on "The Theory of Windings," and later by Hawkins and by Walker? Discussion of the growth, decay, and reversal of a current, and of the energy in the magnetic field form a fitting prelude to commutation. This chapter is well thought out, and the reader is not puzzled with superfluous academic reasoning. The modern view on commutation appears to be that theory is too much upset by magnetic pulsations due to the teeth and the rapidly varying brush contact resistance, while the interpole has rendered unnecessary many of the earlier investigations. Methods of excitation and field winding calculations complete the treatment of the several parts, and enable the author to turn to the performance of the machines.

The load characteristics of direct-current generators and motors are followed by the speed control of motors and starters. Considering its importance, the length of the latter chapter might well have been doubled. Many designers do not understand the inherent properties of the direct-current motor and are unacquainted with some of the modern analytical methods of calculating starters. From efficiency and temperature rise we pass on to testing. The author pays great attention to the several ways of testing a pair of machines; space is also devoted to brush contact drop tests for commutation and to the location of armature faults. A chapter is devoted to boosters and balancers.

The section on design begins with insulating materials, &c., and passes on to mechanical details where data and drawings of the several parts are given. The electrical design is based on the fundamental relations involved in the output coefficient. There is a long discussion on the number of poles, but the argument is rather more suited to a designer than to an inexperienced student—for the latter, examples showing the effect of different numbers of poles are more useful. Main dimensions, armature design, and field system, are illustrated by the detailed design of a 1,000-kW, 500-volt, 300-r.p.m. generator. This is very well carried out. The last chapter gives the complete details of a 150-h.p. motor and a 350-kW generator. Perhaps a complete design of a small—say, 5-h.p. motor—would have brought out secondary details more clearly. At the end of the book are 140 examples, attached to the various chapters, and the answers are also given.

Enough has been said to show that Dr. Clayton's book is crammed with good material, and it will be useful to everyone concerned with the performance and design of direct-current machines. One small matter annoyed us, namely, the footnotes. Practically every one of these should be in the text. As a general conclusion, we should say that relatively less attention might have been paid to the direct-current generator, which seems to be dying rapidly; and more attention to the direct-current motor, which seems to be dying much less rapidly. Consequently, the problems of standard lines and mass production of motors might well have been considered.

Electrical Engineering Practice. By J. W. Meares and R. E. Neale. Vol. II. Pp. ii+532; figs. 244, and 30 plates. London: Chapman & Hall, Ltd. Price 25s. net.

When Mr. Meares set out many years ago to make a single volume "fill the gap between the many excellent pocket books of bare data and the highly technical works written for specialists" in the various branches of electrical engineering, he was attempting a task of no small magnitude. The corresponding task of presenting a useful treatise covering present day electrical engineering practice which he has now set himself and his colleague, Mr. R. E. Neale, is obviously a still severer one, and the collaborators have already discovered the impossibility of condensing the essential matter even into two volumes.

The volume under review is the second of a trilogy, the third and final volume being now in preparation. Most of the new matter throughout the book is from the pen of Mr. Neale, and we may say at once that this second volume amply fulfils the promise held out by the first, of the production of a really up-to-date, practical, and complete treatise. If the present high

standard is maintained in Volume 3 the whole work will stand unique in the literature of electrical engineering. Breadth of view and due consideration of detail are combined with a general lucidity of treatment which make this volume a pleasure to refer to; and we must not omit to congratulate the publishers on the part they have played in the production of the book.

There are eleven chapters in this volume, two dealing with the transformation, conversion and storage of electrical energy, six dealing with distribution systems and control apparatus, and three dealing with applications of electrical energy. This last named constitutes the first three sections of a complete treatment of this subject, the remainder of which occupies the major part of Volume 3.

The chapter on transformation and conversion deals in the space of 126 pages with all the commonly employed forms of energy-converting apparatus, including static transformers, rotary convertors, transvertors, motor-generators, and the various types of mechanical, chemical, and electronic rectifiers. Many of the most insistent of present-day power problems are treated very satisfactorily in this chapter: among the more important may be mentioned frequency changers, and mercury and two- and three-electrode valve rectifiers.

Secondary cells of both the lead and iron-nickel types are discussed fully in the section on the storage of electrical energy, and some space is given to the important distinction between the ampere-hour and watt-hour efficiency ratings of accumulators and the conditions under which such efficiencies are measured.

The first chapter in the section on distribution and control deals with some of the elementary terms and facts relating to electric circuits. While much of this matter is essential, we are inclined to question the necessity for including in such a book as this six figures illustrating series and parallel connections. Systems of supply are adequately covered in a chapter of forty pages, following which are three valuable sections on fittings, switches, and accessories, the control and wiring of branch circuits, and wiring systems. These four chapters constitute a very complete account of the methods at present in vogue for supplying customers with electrical energy for lighting and power purposes by means of overhead or underground transmission lines, and of installing within the consumer's premises suitable apparatus for the effective use and control of the energy supplied.

A short chapter on the cost of electrical installations is worthy of special remark in so far as this all-important subject is almost invariably omitted by writers on electrical engineering.

The two applications of electrical energy dealt with in this volume are those concerned with lighting and heating. One chapter deals very effectively with the various phases of electric lighting practice, while the remaining two chapters cover the whole ground of electric heating, including domestic applications, industrial furnaces, welding, and cutting. The treatment of factory illumination is specially valuable, while the tables summarising the consumption characteristics of various types of electric ovens, furnaces and heaters for industrial purposes are probably unique in completeness and detail of information. The magnitude of recent developments in the utilisation of electrical furnaces is accurately mirrored in this treatise, and the masterly survey here given cannot fail to serve the future growth of this tendency towards the electrification of metallurgical processes.

The extensive bibliographies at the end of each chapter and the very complete index are further commendable features in a work upon which the authors are to be heartily congratulated.

P.H.S.K.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Electrical Companies Co-operate.

In our "City Notes" we print a lengthy abstract of the speech of Sir Philip Nash at the annual meeting of the Metropolitan-Vickers Electrical Company, Ltd., last week.

From the statements made by Sir Philip Nash and Lord Wargrave it appears that Mr. Dudley Docker originally bought control of the British Westinghouse Co. He afterwards sold to Vickers, Ltd. Vickers sold the control to the International General Electric Co. Mr. F. Dudley Docker then came into the transaction, and "the control now lies in his hands." Mr. Dudley Docker has nominated his son, Mr. Bernard Docker, as his representative.

The E.D.A. Circle Campaign.

An electrical exhibition arranged by the Colchester Circle was held at the Town Hall, Colchester, from March 12th to 17th. The opening ceremony was performed by the Mayoress (Mrs. E. H. Turner) who was accompanied by the Mayor (Councillor Turner). This was the first exhibition of the kind to be held in Colchester, and it attracted a great deal of attention. A number of local traders participated, and a very creditable show was the result. Cooking demonstrations were given, and at night the Town Hall was floodlighted. Mr. W. Frisby, the borough electrical engineer, is the chairman, Mr. H. M. Campbell vice-chairman, and Mr. H. E. Bacon, secretary, of the Colchester Circle.

The Blackpool Electric Circle has organised an all-electric house; it was opened on March 17th for a fortnight. This house has been furnished in up-to-date style, and includes every kind of labour-saving device.

Recent Contracts.

Two large battery-driven locomotives have just been completed in this country by the ENGLISH ELECTRIC CO., LTD., for the Bombay, Baroda & Central India Railway. Both of these are fitted with high capacity "Kathanode" batteries, manufactured by the D.P. BATTERY CO., LTD. "Kathanode" batteries have also been fitted in the locomotives built by the English Electric Co. for the Post Office Tube Railway, and on the locomotives supplied by Messrs. Wingrove & Rogers, Ltd., and W. Goodyear & Sons, Ltd., for the new Mersey Tunnel contract.

New French Company.

A company has recently been formed at Crotay to establish a plant near Saint Quentin in the Somme bay to utilise the power of the tides in the generation of electrical energy, by means of the Defour system.

The Easter Holidays.

Our Advertisement Department announces in our other pages to-day that owing to the earlier publication of the ELECTRICAL REVIEW for April 6th new advertising matter for that issue must reach these offices by Wednesday morning, March 28th. Official notices and small prepaid advertisements can be received up to 5 p.m. Monday, April 2nd.

Belgian Electrical Trust.

Various trusts have recently been constituted in Belgium for combining electricity supply undertakings. The latest is the Electro-Trust, which has been formed with a capital of 302,500,000 fr., of which 20 per cent. has been paid by numerous subscribers. The object is to take up an interest in electricity and gas supply works.

Sunderland Council and "Rings."

At a recent meeting of the Sunderland Town Council a recommendation from the Electricity Committee providing for the expenditure of £16,000 on sub-stations and equipment and £20,000 for service mains was considered. A councillor said that the Committee should give details of the prices paid for cables, transformers, &c., as some of the Council were of the opinion that they were paying more than they should pay to "rings." There were "non-ring" firms which could supply the material at about half the cost. The chairman of the Committee said that they could not experiment with cheap cables at the risk of a breakdown of the supply. Eventually an amendment calling for a supplementary estimate was carried.

New Italian Companies.

Among the concerns recently organised in Italy in connection with the electrical engineering industry are the Società Edison-Grimoldi per la Fabbricazione de Machine ed Apparechi Elettrici, Milan, capital 80,000 lire; La Società Fabbrica Italiana Accumulatori Pomcaman, Milan, capital 10,000 lire; La Società Sviluppo Propaganda Elettroapplicazioni e Similari, Turin, capital 100,000 lire; La Società Lampadine Elettriche, Turin, capital 100,000 lire; La Società Industria Commercio Materiali Elettrici, Genoa, capital 100,000 lire; La Società Lampadine Elettriche Thora, Pavia, capital 50,000 lire; La Società Lombarda Costruzione Elettriche Telefoniche, Milan, capital 20,000 lire; La Società Italiana Radio Marittima, Rome, capital 30,000 lire; and La Società Costruzione e Forniture Elettriche, Florence, capital 250,000 lire.

Local Exhibitions.

MALTON (YORKS.).—The Northern Counties Electricity Supply Co., Ltd., held an electrical exhibition in the Assembly Rooms, Malton, from March 12th to 22nd. The room was fitted out with stands upon which all the different types of apparatus were shown, including examples of cookers, with 3-pint kettles, water heaters, and radiators, which are hired out and maintained by the company. Electric washing machines, vacuum cleaners, polishers, sausage machines, coffee grinders, and dough mixers were shown in operation, and demonstrations of cooking were given daily. One room was set aside for lighting fittings with arrangements for showing any one fitting separately.

LUDLOW (Salop).—In connection with the Civic Week which commenced on March 19th and ends to-morrow (Saturday), the Shropshire, Worcestershire and Staffordshire Electric Power Co. has organised a series of electrical demonstrations in the Market Hall. The appliances exhibited in action include cookers, water-heaters, vacuum cleaners, washing machines, &c. Two local firms of electrical contractors—Messrs. Mortimer and Weatherhead and Messrs. G. H. Smallwood & Co.—co-operated with the Power Co. in arranging the display.

Wages in the Engineering Industry.

On March 15th delegates of the trade unions of the engineering industry met representatives of the Engineering and Allied Employers' Federation to present the unions' case for an increase of 8s. in the wages of time workers in the industry, with corresponding rises in piece-work rates. In opening the proceedings, Mr. J. T. Brownlie (president of the A.E.U.) said that the unions were of the opinion that the state of the engineering industry had so improved as to justify the increase for which they asked, to bring their wages nearer to the level which their skill and the importance of the industry warranted. The percentage of unemployed members of the A.E.U. had fallen from 10.22 in April, 1924, to 6.2 at the end of February last. He pointed out that at present the average weekly wages of a skilled man were only 58s. or 59s. a week. If the burden of taxation were too great, the employers were in a better position than the employés to bring pressure upon the Government for measures of relief.

Sir Allan Smith, responding for the employers, said that they must have time to consider the question. Although the engineering employers had made repeated representations to the Government with regard to the burden of taxation, they had met with little success. He also said that they wanted the Ministry of Labour to make a thorough analysis of the unemployment figures to, *inter alia* discover what proportions of unemployed men were skilled, semi-skilled and unskilled.

A Polyglot Engineering Directory.

In view of the necessity for a new and comprehensive engineering directory, and for more effective polyglot propaganda to stimulate the purchase of British machinery, plant and accessories in the markets of the world, the Council of the British Engineers' Association has decided to undertake the publication of a comprehensive "Foreign Buyers' Directory of the British Engineering and Allied Industries," in which the classified headings, explanatory matter and advertisements will appear in English, French, German and Spanish. Its four main sections comprising the language indices, lists of products, and the names and addresses and announcements of the manufacturers in the various languages, will be incorporated in a single large cloth bound volume of about 850 pages, and arrangements are being made for the distribution of ten thousand of these volumes to the machinery buying centres, important departments, and to engineering buyers overseas. Only British firms will be eligible to appear in the directory, and every engineering and allied firm or company possessing the necessary qualifications in Great Britain and Northern Ireland will be entitled, free of charge, to a three-line entry, comprising name of firm, office, and works addresses, telegraphic and cable addresses, and a short description of manufactures. The offices of the B.E.A. are at 32, Victoria Street, London, S.W.1.

Indian Electrical Imports.

Mr. Ainscough, Senior Trade Commissioner in India, has made a survey of the import trade of the country during the first nine months of the fiscal year—April 1st to December 31st, 1927. In the course of this it is shown that imports of electrical machinery were valued at Rs.152 lakhs (against Rs.173 lakhs in the corresponding period of 1926). The shares of all countries were reduced. British shipments fell from Rs.140 to Rs.128 lakhs, the United States' from Rs.16 to Rs.10 lakhs, and Germany's from Rs.8 to Rs.7 lakhs. The total imports of electrical instruments, apparatus, appliances, and parts thereof advanced from Rs.179 lakhs to Rs.202 lakhs. The British share rose from Rs.118 to Rs.134 lakhs, while that of the United States fell slightly from Rs.27 to Rs.25 lakhs. Germany increased her shipments from Rs.16¼ to Rs.19 lakhs. The imports of electric wires and cables rose from Rs.59 to Rs.66 lakhs, the increased trade being almost entirely secured by the United Kingdom, whose share advanced from Rs.51 to Rs.58 lakhs. In electric glow lamps and parts thereof the total of Rs.18 lakhs was divided between the Netherlands Rs.6¼ lakhs, the United Kingdom Rs.5 lakhs, Germany Rs.1¼ lakhs, and "unspecified countries" Rs.5 lakhs. Electric lamps of other kinds amounting to Rs.5¼ lakhs were almost entirely obtained from the United States. Rs.23 lakhs' worth of electric fans imported were obtained from the United Kingdom (Rs.14 lakhs), Italy (Rs.5 lakhs), U.S.A. (Rs.1¼ lakhs), and "other countries" (Rs.2¼ lakhs). Of a total of Rs.35 lakhs' worth of unenumerated electrical apparatus, the United Kingdom supplied Rs.21 lakhs, the United States Rs.7 lakhs, and Germany Rs.4¼ lakhs. Accumulators were imported to a total of Rs.16 lakhs, of which the United Kingdom supplied Rs.14 lakhs, and the United States Rs.1 lakh. Meters and switchboards were almost entirely obtained from the United Kingdom, but of the Rs.7 lakhs' worth of batteries imported, the United States supplied Rs.4¼ lakhs, the United Kingdom Rs.1 lakh, and "other countries" Rs.1¼ lakhs.

Amalgamations in the Electrical Industry.

In the article bearing this title, by Mr. A. W. Willsmore, which appeared in our last issue, two lines were inadvertently omitted. The opening of the second paragraph should read as follows:—"Amalgamations in industry have been of very widely different types. Perhaps the commonest form is the combine. This is an amalgamation of several businesses aiming at a complete mergence, under one management, of the businesses connected with a particular industry. The usual method of procedure is for the shareholders of the various merging companies to exchange their holdings in the individual firms for shares in a main holding company, which thus controls all the individual concerns."

Catalogues Wanted.

MAGSTARLITE, LTD., 325, King Street, Hammersmith, W., is wanting catalogues and specifications of universal motors from 1/40 to ¼ h.p., silent plain bearings.

Trade Announcements.

Messrs. WILLIAM C. YUILLE & CO., LTD., 155a, St. Vincent Street, Glasgow, and Messrs. W. E. BEARDSALL & CO., LTD., 5, Victoria Bridge, Manchester, have been appointed by Vampires, Ltd., 435-437, Oxford Street, W.1, sole representatives for their machines, in Scotland, and Lancashire, Yorkshire and Cheshire, respectively.

The MULLARD WIRELESS SERVICE CO., LTD., states that Mr. A. Beal Pritchett, managing director of the firm of that name which represents the company in Australia, is now in England on a business visit.

The Leeds branch and stores of the MACINTOSH CABLE CO., LTD., in charge of Mr. J. R. Tommis, has been removed to 26, Park Place, Leeds. (Telephone: Leeds 26757; telegrams: "Macintosh, Leeds"). The company's executive office for the South Wales district has been transferred from Cardiff to 6, Park Row, Bristol, in charge of Mr. A. C. Wiley. (Telephone: Bristol 1955; telegrams: "Conductor, Bristol.")

New Catalogues and Lists.

THE ELECTRICAL EQUIPMENT & CARBON CO., LTD., 107-111, New Oxford Street, W.C.1.—March stock list of motors, generators, carbons, bell transformers, &c.

MESSRS. W. CANNING & CO., LTD., Great Hampton Street, Birmingham.—A leaflet illustrating examples of chromium plating.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—The "Osram-G.E.C. Bulletin" for March, containing illustrated articles and notes on "Osram" lamps and lighting developments; "Osram" valves and their applications; the "Gecophone" gramophone pick-up; "Magnet" domestic appliances, baking ovens, &c.

THE CREDENDA CONDUITS CO., LTD., Oldbury, nr. Birmingham.—A priced and illustrated catalogue of conduits and fittings; a leaflet illustrating (with prices) "Credalux" industrial lighting reflectors; a leaflet advertising the company's water-heating appliances (illustrated and priced); and a pocket price list of cables.

SIR W. H. BAILEY & CO., LTD., Albion Works, Salford.—Catalogues Nos. 3027 and 3127, dealing respectively with "Davidson" horizontal and vertical steam pumps. Both are very detailed and fully illustrated.

MESSRS. J. A. CRABTREE & CO., LTD., Lincoln Works, Walsall.—Leaflet No. 1004, containing illustrated particulars and prices of "underslung" and "open type" quick-make-and-break tumbler switches.

MESSRS. A. P. LUNDBERG & SONS, LTD., 477-489, Liverpool Road, Holloway, N.7.—Leaflets E1.43, illustrating and describing two-pin plug connectors with bakelite covers and plugs; and E1.44, dealing with a 5-A limiter switch plug.

MR. ALAN WRIGHT, 124, Chancery Lane, W.C.2.—Catalogue No. 45B, describing "Hazemeyer" dimmers and regulators for theatres and kinemas. Priced and illustrated.

MESSRS. JOHN MOORES & CO., Ravald Street Works, Salford.—A price list (No. 328) of many kinds of insulating materials and manufactures.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—List No. P230, illustrating and describing "Aeroflex" light-duty rewirable cartridge fuses.

MESSRS. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—A profusely illustrated booklet describing the company's electric shaker conveyors for mines.

TUNGSRAM ELECTRIC LAMP WORKS (GREAT BRITAIN), LTD., 72, Oxford Street, W.1.—An illustrated price list of "Tungsram" lamps of many patterns.

SADIA, LTD., 22, Newman Street, Oxford Street, W.1.—A coloured showcard (17 in. by 11 in.) advertising the company's water heaters.

THE RADIO COMMUNICATION CO., LTD., 34-35, Norfolk Street, Strand, W.C.2.—List 0/128, an illustrated pamphlet describing a 1½-kW continuous wave/interrupted continuous wave marine radio equipment.

MESSRS. DONOVAN & Co., 47, Cornwall Street, Birmingham.—An illustrated leaflet containing a description of switch plugs for portable electrical machinery, complying with Home Office regulations.

Bankruptcy Proceedings.

J. A. HARTIGAN and G. J. D. HARTIGAN (trading as the London Fan & Motor Co.), electrical engineers, 81, Charlotte Street, Tottenham Court Road, W.C.—The first meeting of creditors was held last week at the London Bankruptcy Court, when proofs of debt amounting to £1,279 were submitted. J. A. Hartigan had stated that he was employed by electrical engineering firms until May, 1923. Then, in partnership with his brother and two other persons, he started business as above. In September, 1923, the other two partners were paid out, and the business was continued by the brothers Hartigan, but differences arose between them as to the conduct of the business, and recently a deed of assignment was executed in favour of Mr Pearson, of John Street, Clerkenwell. The latter had sold the business for £200, and the purchasers had formed "The London Fan & Motor Co., Ltd." They employed J. A. Hartigan therein at a weekly salary, but he had no other interest in the business. In September, 1924, the firm borrowed £500, and gave as security a charge on all the assets, including the book debts. The solicitors acting for the lender of the £500 recently gave notice to the book debtors of the charge, and that, coming to the knowledge of the creditors, caused them to press for payment and affected the firm's credit. The debtor, G. J. D. Hartigan, states that the weather of the last two summers seriously affected their fan business. In addition, they had to make many replacements under the terms of their guarantee, and they had lost considerable sums on repairs. No statement of affairs had been lodged by the debtors, but it appeared that the liabilities were estimated at £1,400, against assets consisting of book debts £700, and the £200 received by the trustee under the deed of assignment. The receiving order was made on the petition of the Standard Electrical Co., creditors for £423. A resolution was passed for Mr. E. H. Hawkins, 4, Charterhouse Square, E.C., to act as trustee and administer the estate in bankruptcy, assisted by a committee of inspection.

H. J. PUGH (formerly trading as H. J. Pugh & Co.), electrical engineer, 38, Broadway Parade, Cricklewood.—An application for an order of discharge was made to Mr. Registrar Mellor at the London Bankruptcy Court last week by this bankrupt, who failed in December, 1921. The Official Receiver reported that the liabilities amounted to £470, and the estate had realised £1. Prior to May, 1914, the bankrupt was employed by firms of electrical engineers, and then started business on his own account. He was joined in partnership by W. Savage in 1914, and they traded together until the middle of 1916, when Savage was called up for military service, and retired from the firm. The bankrupt carried on alone until April, 1921, when an execution was levied at the suit of a creditor, and the stock-in-trade and effects were sold thereunder to his mother. She subsequently continued the trading under the registered name of A. E. Pugh. In February, 1921, the bankrupt took additional premises at Edmonton, to which he transferred £100 worth of stock. He traded there under management, but the concern was not successful, and was closed down shortly afterwards. The bankrupt attributed his failure and insolvency to bad trade, and the stoppage of his business during the execution of repairs. The discharge was suspended for three months on statutory grounds.

MILDRED WHITE (trading as White & Co.), electrical factor and agent, 29, Great Pulteney Street, W.—Under a receiving order made on a creditor's petition last February, accounts have been lodged showing liabilities of £2,645, against assets valued at £432. According to the Official Receiver, the debtor states that in 1923, whilst trading in partnership as electrical factors and agents under the style of "White & Co.," at Great Poulteney Street, W., a receiving order was made against her husband, W. R. J. White, who was adjudged bankrupt in October, 1922. In 1923 her husband (who was then undischarged from the bankruptcy) resigned, and she became a partner therein as his nominee, but took no active part in the business, of which her husband thereafter acted as manager and had sole control. In 1924 the partnership was dissolved, Bushell retiring from the business, which, nominally, she thereafter continued under the same style, but, apart from 1925, it was always carried on at a loss, and in November, 1927, there was general pressure by creditors, several of whom had issued writs; about that time her husband ceased to take any further active interest in the business, which thereupon ceased. Shortly afterwards execution was levied at the instance of her father, who was a creditor for £1,000 cash advanced, and the whole of the stock and business effects were sold at a heavy loss. On November 17th, 1927, she executed an assignment in favour of her father of the whole of the book debts, amounting to £598, the consideration being a waiver by him of a demand for immediate payment of his claim. The debtor attended before Mr. Registrar Mellor at the London Bankruptcy Court last week for public examination, which was concluded. She attributed the failure of the business to the profits therefrom having been insufficient to meet the heavy overhead expenses. The following are creditors:—

	£		£
Balco, Ltd.	89	I.T.C., Ltd.	90
Barclays Bank	183	Leeds Flint-Glass Co., Ltd.	195
Cardew, Smith & Ross ...	52	C. Scott Lindsay	359
Eastick, J. J., & Sons ...	27	Power Contracts, Ltd. ...	20
Electric Lamp Factors, Ltd.	21	Sun Electrical Co., Ltd.	105
Fribourg & Freyer ...	30	Spencer, A.	857
General Electric Co., Ltd.	87	Tungstalite, Ltd.	31
Mrs. Hope	150	Vyth, H.	52
Hart Accumulator Co., Ltd.	54	White, J. R., & Co. ...	24

P. L. LITTON, trading as Moore & Litton, engineer, plumber and electrical engineer, 12, Bath Road, and 50, Culverland Road, Exeter.—The public examination was held recently at Exeter. In reply to questions, the debtor said that owing to keen competition he had undertaken work at prices which were unremunerative, the work consisting largely of installing electric lighting in new Council houses in the city. He attributed his failure further to bad debts and law costs incurred through creditors suing him. Debtor was aware of his position in November last, but continued in the hope of recovery. He commenced business in partnership with another, and on his partner's death the business was perfectly solvent. Debtor continued the business, undertaking to pay an annuity of £1 weekly for life to his late partner's widow. The estimated liabilities amounted to £786, and the assets, including book debts, were £199, leaving a deficiency of £587. He failed to pay the annuity promised, and shortly before the proceedings the widow took re-possession. The examination was closed.

A. C. COOPER, electrical engineer, 1a, Sherwood Street, Scarborough, Yorkshire.—The first meeting of creditors was held on March 15th, at the Official Receiver's Office, Scarborough. The receiving order was made recently on debtor's own petition. The ranking liabilities were put down at £1,154, against assets of £127, leaving a deficiency of £1,027. Debtor attributed his failure to bad trade, keen competition, lack of capital, and losses on contracts. He had carried on business as an electrical engineer at his present address since June, 1920. His capital amounted to £20, and he had also borrowed money from his father-in-law at different periods, and now owed him £860. He had made no profits during the past three years, but he did not realise his position until December last. The case, being a summary one, was left in the hands of the Official Receiver as trustee of the estate. The following are creditors:—

	£		£
Dawson, Fred	56	Seamer, J. W.	861
General Electric Co., Ltd.	61		

C. L. WEEKS (C. L. Weeks & Co.), electrical engineers, 27a, Charles Street, Newport (Mon.).—First meeting, March 23rd, at 34, Park Place, Cardiff. Public examination, April 3rd, at the Town Hall, Newport, Mon.

H. N. SHORROCK, electrical engineer, 79, Granville Road, and Holling's Yard, Heysham Road, Morecambe.—First meeting, March 22nd, at the Official Receiver's offices, 9, Cannon Street, Preston. Public examination, March 23rd, at the Sessions Hall, Preston.

A. J. WELLS, electrical engineer, lately carrying on business in partnership at 52, Princes Street, Luton.—Bankrupt discharged subject to consenting to judgment for £10 being entered against him (£10 paid to Official Receiver in lieu of entering judgment).

G. S. DOUTHWAITE (G. S. Douthwaite & Co.), electrical engineer, 25, Dean Street, Newcastle-on-Tyne.—Last day for proofs for dividend, April 2nd. Trustee, Mr. A. J. Gray, 48, Pilgrim Street, Newcastle-on-Tyne.

P. FORD, electrical contractor, 4a, Macdonalds Lane, Corporation Street, Manchester.—First and final dividend of 11¼d. in the £, payable March 26th, at the Official Receiver's offices, Byrom Street, Manchester.

Company Liquidations.

HOLBROOK'S ELECTRIC SERVICE CO., LTD.—A meeting of members is called for April 16th, at Africa House, W.C.2, to hear an account of the winding up from the liquidator, Mr. J. Hamp.

INTERCHANGEABLE ELECTRIC SIGNS, LTD.—A meeting of members is called for April 27th, at 62, Brook Street, W., to hear an account of the winding up from the liquidator, Mr. C. H. Seaton.

ELECTRICAL & RADIO DISTRIBUTORS, LTD.—A meeting of members is called for April 18th, at 20, Bedford Row, W.C., to hear an account of the winding up from the liquidator, Mr. F. E. Anderson.

Deed of Assignment.

H. E. HAWLEY and F. A. INGRAM (Hawley & Ingram), electrical engineers, 71, Whitfield Avenue, Newcastle-on-Tyne, and 30, Harpfield Road, Stoke-on-Trent.—Particulars of claims by April 5th, to the trustee, Mr. J. T. Sandland, Victoria Chambers, Liverpool Road, Stoke-on-Trent.

Unemployment.

The Ministry of Labour returns for the week ended March 5th showed a decrease of 14,180 in the number of registered unemployed. The total was 1,094,500, as compared with 1,108,680 on February 27th, and 1,144,060 on March 7th, 1927.

Book Notices.

We have received from Messrs. Allen West & Co., Ltd., copies of a souvenir booklet which they have recently produced. In this appears a brief review of the company's history, which commenced in 1910, and then the various departments of the works at Brighton are dealt with step by step. Side by side with the descriptions appear reproductions of pencil sketches which are an attractive means of conveying an idea of the well-spaced and orderly works and offices.

"The Crabtree," Vol. I, No. 3. (J. A. Crabtree & Co., Ltd., Walsall.)—This interesting little journal contains an opportune article entitled "Whither Bound?" upon the impending or rumoured changes in the electrical manufacturing industry. The view is expressed that while some specialists will be drawn into the larger organisations, others will remain as specialists and retain their identity. Another article deals with the use of logarithmic charts in business control.

"The Anglo-American Year Book for 1928" contains all the usual features, the directories in the issue have been carefully revised and brought up to date, and it is stated that the information contained therein is not available in similar form elsewhere. The publishers are the American Chamber of Commerce in London, and the price is 15s. net.

"*Journal* of the Institution of Electrical Engineers." Vol. LXVI. March, 1928. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"Accidents et Dangers de l'Electricité," by Dr. P. Duhem. Pp. 72; illustrated. Paris: Gauthier-Villars et Cie. Price 10 fr.

"Commercial Electrical Measuring Instruments," by R. M. Archer. Pp. xxi+259; figs. 73. London: Sir Isaac Pitman & Sons. Price 10s. 6d. net.

"Books on Mechanical Engineering."—A catalogue of publications on this subject has been issued by the McGraw-Hill Publishing Co., Ltd.

"Science for You," by J. C. Crowther. Pp. x+241. Price 5s. net. "Coloured Thinking," by D. F. Fraser-Harris. Pp. vii+269. Price 5s. net. London: Geo. Routledge & Sons, Ltd.

The National Accumulator Co., Ltd.

As was announced in our last issue, the above company has been formed to effect the amalgamation of the Hart Accumulator Co., Ltd., and the D.P. Battery Co., Ltd. The Hart Co. is best known in connection with the manufacture of accumulators for train lighting as used on the Stone system. It also manufactures accumulators for motor-car starters, wireless and other purposes. The D.P. Battery Co., Ltd., has manufactured large quantities of accumulators for propelling submarines; in fact, we understand that approximately half the British submarines now in commission are driven by D.P. Kathanode batteries. Kathanode batteries are also largely used in electric vehicles of all classes, especially in lorries for the removal of refuse, and cells of this type are employed for electric locomotives used principally for shunting requirements. The company also has been manufacturing for many years accumulators for country house lighting. Mr. Bernard Drake, now chairman and managing director of the D.P. Battery Co., will be chairman of the National Accumulator Co., Ltd. Mr. Drake is one of the pioneers of the industry, as he was for some time managing engineer of the first British Accumulator Company in 1883, and has maintained his connection with accumulators ever since. Sir John Prestige and Mr. Lee, who will be on the board of the new company, are directors of Stone & Co., of train-lighting fame. The offices of the company are 36, Grosvenor Gardens, S.W.1. It is not proposed to make any issue of fresh capital, but in the near future application will be made to the Stock Exchange for a quotation for the 175,000 preferred ordinary shares.

Social Events.

The staff of the SUN ELECTRICAL CO., LTD., held their annual fancy dress carnival at the Victory Hall, Leicester Square, on March 10th, when nearly 200 members of the staff and their friends attended. Many prizes were given for the best and most original costumes. The first prize was won by Mr. L. Genyon and Miss I. Genyon, who impersonated the "Bisto Kids." Among those present were Mr. A. G. Beaver (managing director) and Mrs. Beaver, Mr. D. M. Fraser (Leeds manager), Mr. A. K. Green (Newcastle manager), and several heads of departments. Music was provided by the Cecil Frost Dance Band, and Mr. A. G. Owen acted as M.C.

HENLEY'S Dramatic Club well maintained its high reputation at the performance of "Leah Kleschna" (C. M. S. McLellan) on the evening of Wednesday, March 14th, at the Cripplegate Theatre. A four-act play of quite topical interest in a season that has produced many jewel robberies, afforded opportunities for several members of the club to bring before a large audience of the London staff of Henley's and their friends, abilities of a conspicuous order suited to their particular parts. Mr. Hugh Stanley made a good though somewhat nerve-wracking "Kleschna." Mr. R. K. Edney, as his pal "Schram," once again fitted admirably into the general scheme. Mr. A. T. Maguire as "Paul Sylvaine," a member of the Chamber of Deputies holding strong but humane views on the subject of criminology, played a thoughtful part in a calm and dignified manner. Everybody did well, but our bouquet and chocolates would have gone to Miss Hilda Sneddon, who played the part of "Leah" (the daughter of "Kleschna"). The theme of the play, that somewhere in everyone of us there lies good—deep down perhaps, but only waiting for the right influence to awaken it—was one persistently thought-provoking, making the evening profitable as well as enjoyable.

New Belgian Companies.

A new company has just been formed in Brussels with a capital of 50 million francs and the title La Société Union Générale Belge de l'Electricité, to finance electrical undertakings in Belgium, in accordance with the recommendations of the National Committee of Public Works. Another new undertaking is the Société Union Intercommunale des Centrales Electriques du Brabant (Interbrabant) organised with a capital of 110 million francs to bring under one control the power stations at Droojenbosch of the Compagnie Continentale du Gaz and the Schaerbeek power station of the Société Bruxelloise d'Electricité. These two stations are not only to be interconnected, but also linked up with the Brussels municipal station, that at Hoeylaert of the Compagnie Auxiliaire de l'Electricité and that at Oisquercq, of the Société d'Electricité du Brabant.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.		Price Mar. 20th.	Fortnight's inc. or dec.
a	Acid, Oxalic	per lb.	5¾d.	...
a	Ammoniac, Sal	per ton.	£60	...
a	Ammonia, Muriate (large crystal)	,,	£52	...
a	Bisulphide of Carbon	,,	...	...
a	Borax	,,	£25	...
a	Copper Sulphate	,,	£25 10s.	...
a	Potash, Chlorate	per lb.	3½d. to 4d.	...
a	,, Perchlorate	,,	5½d.	...
a	Shellac	per cwt.	£13 10s.	...
a	Sulphur, Commercial	,,	£11	...
a	,, Roll	,,	£11	...
a	Soda, Chlorate	per lb.	3d.	...
a	,, Crystals	per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks	per lb.	3½d.	...
	METALS, &c.			
b	Aluminium, Ingots	per ton.	£105 to £112	...
b	,, Wire	per lb.	1/¹ to 1/9	...
b	,, Sheet	,,	1/3 to 2/9	...
p	Babbitts Metal and Anti-friction Metal—			
	Grade I	per ton net.	£2'2	£3 inc.
	Grade II	,, ,,	£147	£2 inc.
	Grade III	,, ,,	£78	£1 inc.
c	Brass (rolled metal 2" to 12" basis)	per lb.	9¾d.	...
c	,, Tubes (solid drawn)	,,	11¾d. to 1/-	...
c	,, Wire, basis	,,	9¼d.	...
c	Copper Tubes (solid drawn)	,,	1/1	...
c	,, Bars (best selected)	per ton.	£92	...
c	,, Sheet	,,	£94	...
c	,, Rod	,,	£92	...
d	,, (Electrolytic) Bars	,,	£66 15s.	2/6 inc.
d	,, ,, Sheets	,,	£143 10s.	...
d	,, ,, Wire Rods	,,	£76 15s.	2/6 inc.
d	,, ,, H.C. Wire	per lb.	9¾d.	...
f	Ebonite Rod	,,	2/9 to 2/6	...
f	,, Sheet	,,	2/9 to 2/6	...
n	German Silver Wire	,,	2/2	...
h	Gutta-percha, fine	,,	6/8	...
h	India rubber, Para fine	,,	1/1	½d. inc.
l	Iron Pig (Cleveland No. 3.)	per ton.	65/-	...
l	,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g	Lead, English pig	,,	£21 5s.	5/- dec.
g	Mercury	per bot.	£22 to £22 5s.	12/6 inc.
e	Mica (in original cases) small	per lb.	3d. to 3/-	...
e	,, ,, medium	,,	4/- to 8/-	...
e	,, ,, large	,,	10/- to 20/- & up	...
p	Phosphor Bronze, plane castings	,,	1/3½	...
p	,, ,, drawn bars & rods	,,	1/3	...
p	,, ,, rolled strip & sheet	,,	1/2½	...
p	,, ,, wire	,,	1/3½	...
o	Platinum	per oz.	£17 15s.	...
d	Silicium Bronze Wire	per lb.	10½d.	...
r	Steel, Magnet, in bars	,,	7½d.	...
n	Tin, Block (English)	per ton.	£232 to £2'3 10s.	...
n	,, Wire, Nos. 1 to 16	per lb.	3/10	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Reporting on the lead position on March 17th, Messrs. James Forster & Co. stated:—"The general position in this country remains unchanged, and although arrivals this month are lighter than during February, demand is so slow that there is no apparent shortage of 'spot' metal, supply and demand being about equally balanced. This being so, any sudden increase in demand, such as the placing of Post Office orders with the cable trade, would have an immediate effect on values. Failing any increase, it seems probable that the market will drift to a lower level." The Board of Trade returns for February 1928, were:—Imports, 24,470 tons; exports, 3,310 tons; leaving for home absorption 21,160 tons.

Lighting and Power Notes.

Aldershot.—ELECTRICITY IN BULK.—The Town Council has secured amended terms for a bulk supply of electricity from the War Department power station, which will reduce the payments by approximately £3,000 per annum.

Australia.—NEW SOUTH WALES.—With the object of reducing generating costs at the Ultimo power station and bringing it into line with their White Bay station, the Railway Commissioners will shortly commence the work of replacing the existing plant with larger units. The Sydney *Sun* reports that the installation of the new plant will involve considerable expenditure, and although it will bring the capital cost of the power house to over £1,500,000, the Commissioners have estimated that it will be remunerative. Six large boilers will shortly be installed and will do more work than is performed by 60 of the existing boilers, which were placed in position many years ago, and by present standards are uneconomical. The new boilers will transform 600,000 lb. of water per hour into steam at 275 lb. pressure per square inch. They will be of the latest type, with forced draught chain grate automatic stokers. The existing nine turbo-alternators will be superseded by two new machines with a combined capacity of approximately 44,000 kW. Later, one, or possibly two, additional turbo-generators may be installed, bringing the capacity of the station to approximately 80,000 kW, or more than double the present normal capacity of 36,500 kW. At the present time the cost of generating electricity at Ultimo power station is approximately 40 per cent. greater than at the White Bay power house.

Barnsley.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £7,344 for mains.

Bedford.—ELECTRICITY EXTENSIONS.—The Town Council has adopted a scheme for the extension of the electricity undertaking which is to be submitted to the Electricity Commissioners, together with an application for sanction to a loan of £71,000. The extensions include buildings, &c., £7,500; 7,500-kW turbo-alternator, £29,000; boiler, economiser, fan plant, &c., £12,000; pipe work, £1,500; generator, switchgear and connections, £1,500; 50-ton electric crane and wiring, £1,000; circulating water improvements, £1,500; coal handling plant, £1,000; accommodation for switchgear and other building modifications, £5,000; cable subway, £1,000; and truck gear for Scot banks, £1,000.

Belgian Congo.—HYDRO-ELECTRIC DEVELOPMENT.—It is announced from South Africa that the plant at the power station which is to be constructed at Mwadingusha on the Lufira river in the Belgian Congo by the Société des Forces Hydro-Electriques du Katanga (Sogefor) will have a capacity of 60,000 h.p. Four sets of 15,000-h.p. turbo-generators are to be installed, three of which will be supplied by the Société des Ateliers de Constructions Electriques de Charleroi, Belgium, and one by the American General Electric Co.

Bradford.—STREET LIGHTING.—The Corporation Finance and General Purposes Committee has asked the city electrical engineer to report to the Street Lighting Special Sub-Committee on what steps might be taken with a view to facilitating the provision of electric street lighting in the districts of the city which are within the supply areas of gas companies.

Bromley (Kent).—INSTITUTION SUPPLY.—The West Kent Electric Light & Power Co. has offered to supply electricity to the Board of Guardians for the Institution at 7d. per kWh for the first 1,500 kWh, 6d. for the next 1,500, 5d. for the next 1,500, and 4½d. beyond, with a guaranteed minimum consumption of 12,500 kWh per annum. The matter has been referred to the New Buildings Committee.

Burton-on-Trent.—CHANGE-OVER.—At a recent meeting of the Corporation Electricity Committee the electrical engineer reported on the proposal to change over the supply in Borough Road, St. Paul's Square, Rangemore Street, and Needwood Street from 100 to 200 V. He said this would necessitate the relaying of all the l.p. mains and services and would cost approximately £1,500. It was decided to carry out this scheme.

Canada.—ELECTRICAL DEVELOPMENT.—Official figures recently published show an increase of 13 per cent. in 1927 in the amount of electrical energy consumed in Canada, as compared with 1926. Of the total energy generated by central power stations, 98¼ per cent. was from water-power. Increases in the utilisation of hydro-electric energy were general throughout Canada. Ontario led in the total production of hydro-electric energy at central stations with an output of 5,674 million kWh, followed by Quebec, 4,670; Prairie Provinces, 951; British Columbia, 947; and Maritime Provinces, 138 million kWh. These figures do not include electricity generated by pulp and paper mills and other plants for their own use, which would considerably increase the total consumption of electricity, especially the amount used in the Province of Quebec, where large hydro-electric plants are owned by pulp and paper companies.

Authority to construct and operate central electric power plants, erect h.p. transmission lines and transformers, to expropriate existing power plants and transmission lines and other equipment at its replacement value, and to sell electricity, electrical appliances and equipment to urban and rural dwellers, is being sought in legislation to be introduced at the present session of the Saskatchewan Provincial Legislature. The Minister of Railways, Labour and Industries made this announcement in the Legislature in moving the second reading of the Bill establishing the new Department of Railways, Labour and Industries, and defining its powers and functions. He prefaced his remarks with the statement that the Government would not announce its policy in this connection until it was in possession of the report of the Provincial Power Commission and had had ample time to consider it. The proposal for public ownership of electric power plants and transmission lines met with general support from all sides of the House.

Carlisle.—ELECTRICITY IN BULK.—The Corporation Electricity Committee has been asked by the Dumfriesshire County Council upon what terms the Corporation would be prepared to supply electricity in bulk for distribution by the County Council. The town clerk has been requested to forward an estimate of the terms.

Chesterfield.—ELECTRICITY IN BULK.—The Town Council has applied for sanction to a loan of £16,250 for the necessary equipment to enable a bulk supply of electricity to be taken from the Notts. and Derbyshire Electric Power Co. for a period of five years. The agreement with the Staveley Coal and Iron Co. for a bulk supply of electricity to the Corporation is to terminate on February 2nd, 1929.

Colwyn Bay.—ELECTRICITY SUPPLY.—The engineer, Mr. J. Smith, has presented a report to the Urban District Council on a scheme necessitated by the displacement of the steam-driven d.c. station by the purchase in bulk of an a.c. supply from the hydro-electric plant in Snowdonia. Mr. Smith has recommended the division of the district into areas of nearly equi-voltage drop, in which the l.p. distributing mains will be served from transformers, housed in kiosks. These will be interlinked and fed by 6,600-V ring mains, connected to the present transformer sub-stations. A further precaution against failure in the main supply is suggested by introducing another feeder at 33,000 V to a third transformer sub-station. The estimated cost is approximately £15,000, but only a portion, involving an outlay of about £3,000, is recommended at present. The d.c. supply is being gradually replaced by a.c. for all purposes.

Continental. — SPAIN. — The Sociedad Canalizaciones y Fuerzas del Guadalquivir is establishing a new hydro-electric station at Jandula. The plant will comprise two 8,500-h.p. turbo-generators running at 375 r.p.m., and one set of 4,100 h.p. running at 500 r.p.m. Power will be generated at 10,000 V and will be stepped up by 11,250 kVA transformers to 121,000 V for transmission purposes.

Coventry.—NEW POWER STATION.—The foundation stone of the new power station was laid by the chairman of the Corporation Electricity Committee on March 15th. At the ceremony Mr. A. N. East, of the Electricity Commission, in referring to the Central England electricity scheme, said that the new station would play an important part in the future of electricity supply for that area. The Sandy Lane station also had a future before it, while not so great as that of the new station. There would, in fact, be two stations in Coventry both serving the grid for the purposes of the whole area. The contract for the station is in the hands of the British Thomson-Houston Co., Ltd., and all the work is being carried out to the specification of Mr. G. Tough, city electrical engineer and manager.

Dartford.—SUPPLY TO MILLS.—The Urban District Council Electricity Committee has recommended an agreement for the supply of electricity to Keyes' Daren Mills, Ltd., upon the following terms:—£5 per kW per annum, plus 0.65d. per kWh for loads at less than 40 per cent. load factor, 0.50d. per kWh for loads between 40 and 50 per cent. load factor, and 0.45d. per kWh for all energy consumed in excess of 4,380 kWh per kW per annum. It is estimated that this supply will increase the output from the station by approximately 850,000 kWh per annum. In order to give the supply it will be necessary to provide h.p. transformers and e.h.p. swichgear at an estimated cost of £2,010.

LOAN.—The Committee is applying for sanction to the borrowing of £5,730 for mains.

Doncaster.—LOANS.—The Corporation Electricity Committee has approved application for sanction to borrow £5,570 for new h.p. feeders from the generating station to the Market Hall and Balby sub-stations, and £44,700, being estimated capital requirements during the next two years for mains, services and meters, extensions to existing sub-stations, and provision of h.p. switchgear on consumers' premises.

Gillingham (Kent).—LOANS.—The Town Council has decided to apply for sanction to loans of £2,000 for sub-stations, transformers, &c., and £5,000 for mains and services.

Hastings. — ELECTRICITY EXTENSIONS. — The Corporation Electricity Committee has considered a report from the borough electrical engineer stating that the maximum load on the Broomgrove power station for the past winter months was 6,550 kW, as compared with 5,080 kW for the corresponding

period of last year. The supply from Broomgrove station to St. Leonards is dependent on four cables, the total capacity of which is 2,500 kW, and the supply from Broomgrove to Hastings is dependent on seven cables, the total capacity being 2,500 kW. The maximum supply demanded during the past winter months for St. Leonards was 1,910 kW, and for Hastings 2,454 kW. Assuming that the rate of progress will continue during the next two or three years, and, having in mind the continuity of supply, the borough electrical engineer recommends that extensions be carried out during the coming summer at a cost of £30,384.

LOAN.—The Committee has recommended that application be made for sanction to a loan of £5,000 for meters.

Hereford.—LOANS.—The Town Council is to apply for sanction to loans of £23,348 and £2,000 for electricity purposes.

Jersey.—ELECTRICITY SUPPLY.—The Jersey States (Channel Islands) have granted a concession to Messrs. W. Hunter and Sons, 63, Castle Street, Edinburgh, for the supply of electricity to the whole island. The value of the contracts involved is approximately £250,000.

London.—ST. MARYLEBONE.—The Borough Council Electricity Committee has recommended that application be made for sanction to a loan of £40,000 for the provision of mains and services during the next two years.

ST. PANCRAS.—The Borough Council is to apply for sanction to lay additional feeder mains required to deal with next winter's load at an estimated cost of £3,535.

SHOREDITCH.—The Finance Committee has recommended to the Borough Council that application be made for sanction to a loan of £26,930 for mains.

Luton.—LOAN SANCTIONED.—The Town Council has received sanction to loans totalling £5,786 for converting plant and switchgear.

New Zealand.—AUCKLAND.—The accounts of the Auckland Electric Power Board (chief engineer: Mr. A. O. Glasse) for the year ended March 31st last show a total revenue of £517,120, as compared with £413,881 in 1925-26. Working expenses amounted to £235,337, as against £188,778, and after payment of interest, sinking fund, and other capital charges there was a net surplus of £63,556, as compared with £44,082 in the preceding year. The electrical energy sold increased from 50,528,290 to 66,207,786 kWh, and the maximum supply demanded from 17,752 to 22,610 kW. The distribution system has been extended by 419 miles of cable, and an interesting feature is the development of the domestic load, the increase in connections during the year for this class of supply representing a total of 15,958 kW.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

ST. MARYLEBONE.—Lighting: Flat rate from 4d. to 3½d. per kWh. Annual contract demand and long-term agreements: The "unit" charge from ½d., ½d. and 9/16d. to 13/16d., 9/16d., and ½d. per kWh.

INVERNESS.—Lighting: From 8d. to 7d. per kWh. Power and heating: From 3d. to 2½d. per kWh.

BLACKPOOL.—Lighting: Flat rate from 4½d. to 4d. per kWh; maximum demand system, from 7d. to 6d. per kWh.

BUXTON.—Supply to all classes of consumers: A reduction of ½d. per kWh.

YEOVIL.—*Yeovil Electric Light and Power Co., Ltd.*—Lighting: From 1s. to 10d. per kWh.

DOVER.—Lighting: From 7½d. to 6½d. per kWh, less ½d. per kWh discount for prompt payment of accounts.

WHITBY.—Lighting: From 7d. to 6d. per kWh. The Council has also introduced a domestic tariff of 20 per cent. of the rateable value with a minimum of £5, plus 1d. per kWh.

CANTERBURY.—Lighting: Varying from 5½d. per kWh for the first 100 kWh per quarter to 4d. for over 20,000 kWh. Power: Varying from 1½d. per kWh for the first 500 kWh per quarter to ½d. per kWh for electricity consumed in excess of 7,500 kWh.

South-East Lancashire Electricity Advisory Board.—SPECIAL ORDERS.—The Engineering Advisory Committee has recommended the Board to support the applications for Special Orders by the Marple Urban District Council authorising it to supply electricity in the urban district, and the Alderley Edge and Wilmslow Councils authorising the constitution of the Alderley Edge and Wilmslow Electricity Board.

STALYBRIDGE.—The application of the Stalybridge, Hyde, Dukinfield, and Mossley Tramways and Electricity Board for authority to extend the Hartshead power station by the installation of two 7,500-kW sets, with boilers, buildings, &c., at an estimated cost of £170,000, has been considered by the Committee, and the Advisory Board has been recommended to support the application to construct buildings and civil engineering works in connection with the proposals and to install one 7,500-kW set with relative boiler and auxiliary plant.

MACCLESFIELD.—The Committee has had under consideration an application from the Electricity Co. of Macclesfield, Ltd., for sanction to install additional plant, and having considered the offers of bulk supplies from Manchester and Stockport Corporations is of opinion that a bulk supply is not available for the company without prejudice to it unless assistance is rendered by the Electricity Commissioners and/or the Central Electricity Board. The Committee has therefore resolved that the last two authorities be requested to assist, if possible, the furnishing of a bulk supply to the company having regard to the contemplated ultimate development of the area generally, and that, failing this assistance, the Electricity Commissioners be recommended to consent to the installation of plant.

BUXTON.—The Corporation has applied for authority to install one 340-kW Diesel set with accessories, buildings, &c., at an estimated cost of £10,000, and the Committee has recommended the Board to approve the installation of an additional generator, but, in view of the improbability of a bulk supply being available before 1932, the Corporation is recommended to consider the installation of a rather larger set than that suggested in its application.

The proceedings of the Engineering Advisory Committee have been approved by the Board.

Special Orders.—Application has been made to the Electricity Commissioners for a Special Order by Middlesbrough Corporation authorising it to extend its area of electricity supply so as to include the parish of Acklam.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising Bridport Corporation to supply electricity in the borough and parts of the rural districts of Bridport and Beaminster.

Tunbridge Wells.—LOANS.—The Town Council has applied for sanction to a loan of £39,460 for mains, sub-stations, and sub-station pillars.

Whitehaven.—ELECTRICITY SUPPLY.—The Rural District Council has applied for approval of an electric lighting scheme at Thornhill, comprising street lighting and the wiring of houses built by the Council. The estimated cost is £2,100. The Council has also decided to approach the local Waste Heat Co. with regard to a supply of electricity for the parish of Beckermet.

Tramway and Railway Notes.

Bradford.—PROPOSED NEW TRAMWAYS.—The Corporation is seeking powers to authorise certain tramways in the borough of Brighouse and the urban district of Hipperholme, and the West Riding County Highways Committee has asked for clauses for the protection of main roads and bridges.

Colchester.—ABANDONMENT OF TRAMWAY.—The Town Council is to apply to the Minister of Transport for an Order authorising it to discontinue the tramway service on the East Gates route. It is proposed to introduce a motor-omnibus service on this route.

Continental.—SPAIN.—A new electric narrow-gauge railway has recently been completed by the Sociedad Minera Penarroya, between Puertollano and Conquista. It forms an extension of the existing line between Penarroya and Puertollano, and is mainly intended for freight transport. The new line, which is about 34 miles in length, is supplied with power from the steam-operated generating stations belonging to the company at Penarroya and Puertollano.

Glasgow.—PINKSTON STATION EXTENSION.—The Corporation on March 15th decided to install new plant at Pinkston power station at an estimated cost of £237,500. Offers will now be taken for the following:—One new 18,750-kW turbo-alternator, six new 50,000-lb. boilers to replace the present boilers; h.p. switchgear and necessary alterations to buildings, and additional rotary convertors in Dalhousie, Coplawhill, Partick, and Bellahouston sub-stations.

Halifax.—PURCHASE SCHEME ABANDONED.—The negotiations between the Corporation and Bradford Corporation for the purchase by Bradford of the Halifax tramway from Brighouse to Bailiff Bridge have failed, and the proposal to purchase has therefore been abandoned.

Japan.—NEW ELECTRIC RAILWAYS.—The Mandai Electric Railway has applied for a charter authorising the construction of an electric railway, 14 miles in length, from Niigatu railway station to Niitsu-machi, at an estimated cost of 1,500,000 yen.

The Ise electric railway is to be extended by 14 miles, between Matsuzaka-machi and Uji-Yamada, Miye-ken, at a cost of 3,000,000 yen.

New electric railways authorised include the Aitoku railway (12 miles), Josei railway (9 miles), and the Shichihyo railway (21 miles).

Lanarkshire.—TRAMWAY OVER NEW BRIDGE.—*The Times* reports that negotiations between the local authorities of Lanarkshire and the Lanarkshire Tramways Co. on the question of laying a tramway track on the new bridge over the River Clyde between Motherwell and Hamilton have had a surprising sequel. At the instance of the Tramway Company there was recently served on the clerk of Lanarkshire County Council a note of suspension and interdict, in which it was asked that the local authorities should be interdicted from proceeding further with the work of constructing the approach to the new bridge on the Hamilton side, in so far as it might encroach on the existing tramway lines and interfere with tramway traffic. The authorities have decided that they have no statutory powers at present to accept the company's suggestion that they should meet the cost of laying the track, and they are to defend the action for interdict.

Telegraph and Telephone Notes.

Canada.—ATLANTIC-PACIFIC LINE.—The New Brunswick Telephone Company will complete during the present year the eastern extension of the proposed all-Canada telephone line from the Atlantic to the Pacific. Two new copper circuits will be built from Saint John to the Quebec boundary near Edmundston, to connect there with the Bell telephone lines. This will involve 510 miles of copper, and it is expected to give very much better service with Montreal and Western Canada.

TELEPHONE DEVELOPMENT.—The Manitoba Government has set aside the sum of $1,000,000 for telephone extension work in the province this year. This extension will include linking up The Pas and the new northern Manitoba mineral district with Winnipeg and also extensions to rural lines.—*Reuter* (Winnipeg).

Continental Telephony.—LUXEMBURG SERVICE.—A telephone service between this country and the Grand Duchy of Luxemburg was inaugurated on March 15th. Communication is available from all parts of Great Britain, but will be restricted initially, in the Grand Duchy, to Luxemburg City.

Mexico.—LONG-DISTANCE TELEPHONY.—Long-distance telephone services have recently been established between Mexico City and all towns in the United States, with Cuba, and with Canada.

Radio Telephony.—PARIS-ALGIERS.—*The Times* reports that communication between Paris and Algiers by means of short-wave beam wireless telephony was opened on March 19th, when M. Bokanowski, the French Minister of Commerce, spoke to M. Bordes, the Governor of Algeria. M. Bordes could not reply, as communication is at present unidirectional.

The Telephone Service.—CHESTER AND NORTH WALES DEVELOPMENT.—We have received from Mr. R. A. Weaver, superintending engineer of the Chester, North Wales and Hanley District Telegraph and Telephone Advisory Committee, a copy of his report for the year ended December 31st last. A number of new exchanges were opened, and extensions were made to several existing exchanges. New telephones installed increased by 2,817 to 34,603, and the number of effective trunk calls was 3,711,620, an increase of 15 per cent., as compared with 1926. Local effective calls totalled 15,164,211, an increase of 11.6 per cent. The number of written complaints received was 11.03 per 100,000 calls on the local service, and 6.72 on the trunk service.

Radio Notes.

British Broadcasting Corporation.—P.O. GRANT.—The *Daily Telegraph* states that during the twelve months ending March next the Post Office expects to be in a position to make a bigger grant to the British Broadcasting Corporation. It will amount to £880,000, and it exceeds the figure for the current financial year by £75,000. This fact is disclosed in the estimates for the Revenue Departments recently issued. From the revenue which the Post Office receives from wireless licences it first deducts 12½ per cent. for the cost of collection, and it then pays over to the broadcasting authorities 90 per cent. of the balance as regards the first million licences, 80 per cent. as regards the second million, and 70 per cent. as regards the third million. There were 2,451,051 licences in existence at the end of last month, and the number is being added to at the rate of 1,000 a day.

China.—NANCHANG.—In addition to the short-wave wireless station recently built at Nanchang, Kiangsi provincial capital, the authorities are contemplating the construction of a broadcasting station there and the installation of receiving sets in all districts in the province, so that lectures and news may be broadcast from the capital to the whole province. A short-wave wireless station has also been built at Kiukiang, Kiangsi province, for military use.

France.—BROADCASTING.—The Paris correspondent of *The Times* reports that the Chamber adopted, on March 13th, a measure introduced by the Government to regularise, until definite legislation is passed, wireless broadcasting from French stations. This measure authorises the Government to renew the broadcasting licences of all stations existing before December 31st, 1927, the date when the last legislation on the subject expired. Broadcasting stations created after that date must be closed, and those which have been transformed or improved must revert to their original condition within a month of the promulgation of the Bill. The erection of new stations will not be permitted for the present, but those devoted to experiment and research will be allowed to function.

Sweden.—WAVE-LENGTHS.—The Stockholm correspondent of *World Radio* reports that, for the purpose of freeing it from interference with the new Zeesen station, the wave-length of Motala has been raised to 1,380 m. Boden's wave-length is also changed, in consequence of interference with Stambul. It is now transmitting on 1,190 m.

LICENCES.—Nearly 350,000 licences were issued in Sweden by March 1st. This is an increase, since the beginning of 1928, of about 20,000.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—SYDNEY.—May 16th. N.S.W. Government Railways. One water-tube boiler and accessories for Zara Street power house, Newcastle. (Spec. 10s.)

July 18th. Six water-tube boilers and accessories for Ultimo power house. (Spec. £2.) Chief Electrical Engineer, 61, Hunter Street, Sydney, New South Wales.

MELBOURNE.—May 8th. P.M.G.'s Department. Standard resistances, condensers, &c. (B.X. 4274.)*

Aylesbury.—Electricity Department. Twelve months' supply of cable, ironwork, l.p. insulators, a.c. meters, poles, joint boxes, cut-outs, &c. (March 16th.)

Birmingham.—April 5th. Board of Guardians. X-ray plant, Selly Oak Union Hospital. Schedule and particulars from steward.

Blackpool.—April 5th. Electricity Supply Department. 6,600-V, 150-kVA, 3-phase transformers, and 6,600-V, 3-phase, sub-station switchgear. (See this issue.)

Clutton.—April 23rd. Board of Guardians. Electric lighting installation, Institution. Mr. I. Hood, engineer, 40, Queen's Road, Clifton, Bristol. (Returnable deposit of £2 2s.)

Crediton.—March 28th. Board of Guardians. Installation of electric lighting at the Poor Law Institution, Western Lodge, Crediton. Specifications from the Master at the Institution.

Dundee.—Corporation. Electric lighting installation, &c., at the Lawton Farm housing scheme. Particulars from Mr. George Baxter, city engineer.

Egypt.—CAIRO.—April 12th. Ministry of the Interior. Diesel engine alternator set for Suez electric light station. (B.X. 4252.)*

May 17th. Two Diesel engine driven generating sets for Mansourah. (B.X. 4277.)*

Glasgow.—March 26th. Corporation. Installation of electrical passenger lift at buildings in Trongate and Stockwell Street. Public Works office, 64, Cochrane Street.

Hoylake.—March 24th. Electricity Department. Motor-generator and switchgear. (March 16th.)

Ilford.—April 4th. Electricity Department. Paper-insulated cables. (See this issue.)

India.—March 29th. Indian Stores Department, New Delhi. One 70-kW 120-V d.c. steam-driven generating set. (B.X. 4256.)*

Irish Free State.—DUBLIN.—April 4th. Electricity Supply Board. Erection of overhead electricity distribution mains and services in Celbridge, Kelcock, Maryborough, Maynooth, Mountmellick, Naas, Newbridge, and Rathaugan. (March 9th.)

March 24th. Borough Commissioners. E.h.p. and l.p. cables, cast iron and stoneware troughing, section pillars, compound, &c. (March 2nd.)

Irvine (Ayrshire).—March 26th. Town Council. Electric lighting at ten blocks of houses. Specifications (one guinea deposit) from Mr. A. R. Wilson, town clerk, Council Chambers, Irvine.

Loanhead.—March 30th. Town Council. Electric lighting installation for 40 houses. Schedules from Mr. G. B. Deas, architect, Central Chambers, Kirkcaldy (deposit of £1).

London.—LONDON COUNTY COUNCIL.—April 16th. E.h.p. switchgear for Greenwich power station. (March 9th.)

PADDINGTON.—April 12th. Great Western Railway. Electric wires and cables, telegraph ironwork, electric lamps. (See this issue.)

Manchester.—March 26th. L.p. water and oil pipework, &c., for auxiliary services (Section B), Barton power station. (March 2nd.)
April 4th. Electric radiators. (March 16th.)
April 12th. Central Purchasing Committee. Incandescent lamps for 12 months. (See this issue.)

Newport.—April 5th. Isle of Wight C.C. Installation of central heating and electric lighting, County Hall. Mr. S. R. Cocks, county surveyor, 4, St. Thomas' Street, Ryde.

New Zealand.—WELLINGTON.—April 17th. Post and Telegraph Department. Head receivers. (B.X. 4239.)*

Norwich.—March 26th. Electricity Committee. Erection of 16 miles of 33,000-V overhead line. (March 9th.)

Rhondda.—March 31st. Electricity Department. Twelve months' supply of meters, cables, joint boxes, compound, cut-outs, &c. (February 24th.)

Salford.—April 2nd. Tramways Committee. Electric lamps, steel tires, axles, gears. General manager, Corporation Tramways, 32, Blackfriars Street.

South Africa.—JOHANNESBURG.—April 24th. Town Council. Two 10,000-kW turbo-generators, with condensers. (B.X. 4266.)*
April 26th. A.c. and d.c. house-service meters. (B.X. 4262.)*

Stafford.—March 29th. Education Committee. Installation of electric lighting at Brierley Hill, Mill Street Schools, &c., and at the Girls' School, Tamworth. (March 9th.)

Stoke-on-Trent.—May 9th. Electricity Department. One 12,500-kW turbo-alternator and condensing plant. (See this issue.)

Uruguay.—MONTEVIDEO.—May 3rd. State Electricity Works. One 75-kW Diesel-engine generating set, with accessories and spares. (B.X. 4270.)*

West Lothian.—March 31st. Education Authority. Electrical work at the new Technical and Roman Catholic Schools, Bathgate. Specifications (one guinea deposit) from Mr. Blades, executive officer, Education Offices, Bathgate.

Whitehaven.—March 26th. Rural District Council. Overhead cable, street-lighting fittings, and internal wiring of 183 houses, St. John, Thornhill. Mr. W. J. Goode, surveyor, Union Hall.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bradford.—Tramways Committee. Accepted:—
Manganese steel rails (£347).—Hadfields, Ltd.
100 tramway poles (£665).—Bromford Tube Co., Ltd.

Canterbury.—Corporation. Accepted:—
One 30-cwt. "Electricar" low loader for refuse collection work.—Electricars, Ltd.

Cheadle and Gatley.—Electricity Department. Accepted. Annual supplies:—
Paper-insulated, lead-covered and armoured cable.—Hackbridge Cable Co., Ltd.
Electricity meters.—Ferranti, Ltd., British Insulated Cables, Ltd., Chamberlain & Hookham, Ltd.
Electric lamps.—British Thomson-Houston Co., Ltd.; Edison Swan Electric Co., Ltd.; Metro-Vick Supplies, Ltd.
Creosoted wood cover boards.—C. W. Norris & Co.
Overhead distribution cables, &c.—Macintosh Cable Co., Ltd.

Glasgow.—Tramways Committee. Recommended:—
Link insulators.—British Insulated Cables, Ltd.

The Tramways Committee's proposal to accept the tender of the Magna Wire and Cable Co., Ltd., at £2,104, for the supply of lead-covered cable was rejected on a division, the Committee being authorised to accept the lowest British tender (£2,311).

Parks Committee. Recommended:—
Electrically-driven air compressor for sewage plant at Glasgow Green (£120).—Adams Hydraulics, Ltd.

Gravesend.—Electricity Committee. Accepted:—
200-kVA transformer kiosk and switchgear (£376).—British Electric Transformer Co., Ltd.

Kettering.—Electricity Department. Accepted:—
E.h.p. and l.p. feeders.—Union Cable Co., Ltd.
Transformers.—British Electric Transformer Co., Ltd.

Leyton.—Town Council. Accepted:—
1,500-kW convertor (£4,630).—Brush Electrical Engineering Co., Ltd.

London.—ISLINGTON.—Electricity Committee. Recommended:—
Air extractor for turbine condenser (£355).—Hick, Hargreaves & Co., Ltd., Bolton.
Voltage regulator (£500).—C. A. Parsons & Co., Ltd.

KENSINGTON.—Health Committee. Recommended:—
Additions to electric lighting at swimming baths (£120).—R. Brightwell, Ltd.

ST. PANCRAS.—Contract and Stores Committee.
Three 1,000-kW motor convertors, for sub-stations (£11,045).—Brush Electrical Engineering Co., Ltd.
L.p. cable (£546).—Hackbridge Cable Co., Ltd. (£227), Greenwich Cable Works, Ltd.
E.h.p. cable (£9,184).—Hackbridge Cable Co., Ltd.
Stoneware ducts.—Albion Clay Co., Ltd.
Switchboard panels (£451).—J. G. Statter & Co.
Illuminated signs at the Kings Road generating station (£448).—Franco-British Electrical Co.

WAR OFFICE. Accepted:—
Water tube boilers for the Woolwich Arsenal power station.—Yarrow & Co., Ltd.

METROPOLITAN WATER BOARD. Recommended:—
Material required in connection with the installation of electrically driven pumps at Hampton works (£327).—Hackbridge Cable Co., Ltd.

HAMMERSMITH.—Electricity Committee recommended:—
Annual contracts:—
Stoneware conduits.—Doulton & Co., Ltd.
Insulating compound.—Dussek Bitumen Co., Ltd
Cables.—Connollys (Blackley) Ltd.
Electrical goods.—Falk, Stadelmann & Co., Ltd.
Insulated wires.—Edison Swan Electric Co., Ltd.
House service and joint boxes.—Siemens Bros. & Co., Ltd.
Meters.—Chamberlain & Hookham, Ltd., Metropolitan-Vickers Electrical Co., Ltd.

Middlesbrough.—Corporation. Accepted:—
One mile of l.p. triple concentric cable (£898).—Macintosh Cable Co., Ltd.

Pershore.—Rural Council. Accepted:—
Wiring 36 houses at Cornmore for electric lighting and cooking.—Abell & Smith.

Portsmouth.—Electricity Committee.
Switchgear (£512).—English Electric Co., Ltd. (Accepted.)
Steel pipework and feed pumps:—

JOHN SPENCER, LTD. (Accepted.)	£1,800
Aiton & Co., Ltd.	1,963
Babcock & Wilcox, Ltd.	2,007
Stirling Boiler Co., Ltd.	2,060

Overhead main transmission lines to Petersfield:—

JOHNSON & PHILLIPS, LTD. (Accepted.) ...	£5,574
Foundation Co., Ltd.	5,782
Callender's Cable & Construction Co., Ltd. ...	5,803
Siemens Bros. & Co., Ltd.	5,823
W. T. Henley's Telegraph Works Co., Ltd. ...	5,926
British Insulated Cables, Ltd.	5,995

Rotherham.—Tramways Committee. Recommended:—
Manganese steel points and crossings (£307).—Hadfields, Ltd.

Ryde.—Town Council.
Lighting and illuminating the pier by electricity:—

C. LANGDON. (Accepted.)	£884
Bowerman Bros.	1,201
Isle of Wight Electric Light and Power Co.	989
Vosper & Co.	904
C. Bassham (Ashton & Holt)	863

Sunderland.—Corporation. Accepted:—
Installation of two additional boilers, with accessory plant, at the Hylton Road generating works.—Spearing and Co., Ltd.

Workington.—Accepted:—
Electrical installation at police station, courts, &c.—T. S. Bell & Co. (Workington).

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

THORAM or TORAM lamps.
Electric motors marked with the letters "C.E.P." contained in two concentric circles.
A machine for polishing wood panels (not a floor polisher).
KIT-KAT fuses. (These fuses are also marked "The only way," and have an arrow through the word "only.")
ELECTROLIA 3-way switches.
RAPID hair dryer.
The AUSTIN system of direct-current motor control.
DUPLEX 75 rotary floor polisher.
An iron marked "R.W."

Forthcoming Events.

Junior Institution of Engineers.—Friday, March 23rd. 39, Victoria Street, S.W. 7.30 p.m. "High Tension and Low Tension Supply for Wireless Receivers from Electric Mains." Mr. B. J. Axtens.

Friday, March 30th. 7.30 p.m. "Locomotive Maintenance." Mr. C. F. Adams.

Chemical Engineering Group.—Friday, March 23rd. Burlington House, W.1. 8 p.m. "Ultra-violet Radiation in Industry." Mr. A. A. King.

Birmingham Electric Club.—Friday, March 23rd. Grand Hotel. Annual dinner.

Institution of Production Engineers.—Friday, March 23rd. 83, Pall Mall, S.W. 7.30 p.m. "Plant Maintenance." Mr. R. H. Hutchinson.

Physical Society.—Friday, March 23rd. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Meter Engineers' Technical Association.—Friday, March 23rd. Lighting Service Bureau, London, W.C.2. 7 p.m. Annual general meeting.

British Electrical Development Association.—Friday, March 23rd. Royal Society of Arts, John Street, Adelphi, W.C. 7.30 p.m. "Personal Salesmanship." Mr. R. W. Brymer.

Royal Institution of Great Britain.—Saturdays, March 24th and 31st. 21, Albemarle Street, W. 3 p.m. "The Transformation of Matter." Sir Ernest Rutherford.

Friday, March 30th. 9 p.m. "Radio-active Atoms and their Structure." Sir Ernest Rutherford.

Illuminating Engineering Society.—Tuesday, March 27th. Discussion on "Various Aspects of Street Lighting."

Electrical Power Engineers' Association (Southern Division).—Wednesday, March 28th. Institution of Electrical Engineers, Victoria Embankment, W.C.2. 7 p.m. "Some Experiences with Heated Air on Mechanical Stokers." Mr. J. T. Ruddock.

Institution of Electrical Engneers.—Thursday, March 29th. Institution, London, W.C. 6 p.m. "The Electrification of the Pietermaritzburg-Glencoe Section of the South African Railways." Mr. F. Lydall.

(Irish Centre (Dublin)).—Tuesday, March 27th. Trinity College, Dublin. 7.45 p.m. "Electric Ploughing." Mr. R. B. Matthews.

(North-Eastern Centre).—Monday, March 26th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "Practice and Progress in Combustion of Coal as applied to Steam Generation." Mr. F. H. Rosencrants.

March 27th, 28th, and 29th. Carliol House, Newcastle-on-Tyne. 5.45 p.m. Exhibition of film illustrating the new Anglo-American Telephone Service.

(South-Midland Centre).—Wednesday, March 28th. University, Birmingham. 7 p.m. "The South African Railway Electrification Scheme." Mr. F. Lydall.

(London Students' Section).—Friday, March 23rd. Institution, London, W.C. 6.15 p.m. "The Vacuum Tube Family." Mr. G. P. Barnard.

Thursday, March 29th. Albert Tavern, Victoria Street, S.W. 7.30 p.m. Smoking concert.

(North-Eastern Students' Section).—Friday, March 30th. Lighting Service Bureau, Deal House, Northumberland Street, Newcastle-on-Tyne. 7.15 p.m. Annual general meeting. Paper by Mr. V. A. H. Clements.

(North-Western Students' Section).—Tuesday, March 27th. Milton Hall, Manchester. 7 p.m. Annual general meeting. "On-load Voltage Regulators, with special reference to Transformer Regulators." Mr. W. L. England.

Notes.

Traffic Light Signals.

A *Morning Post* correspondent states that all the main avenues in "down-town" New York are now equipped with red and green signal lights, allowing north and south traffic to proceed for an interval of two minutes twenty seconds, after which east and west traffic has a clear road for one minute fifteen seconds. In a few months all these lights will be controlled from one master station. All the lights on one avenue change at the same time for the full length of the avenue, and some parallel avenues a short distance apart change the lights at the same time. It is stated that the New York light system has speeded up traffic materially, and that the system saves the city the need of 5,000 additional traffic policemen, although it by no means abolishes the need for personal guidance of the traffic.

The amber caution light, used for the benefit of pedestrians when the light system was first introduced, has been abolished. It appeared to lead to accidents, since the stopped traffic took it as a signal to proceed, while moving traffic regarded it as permission to continue for a few seconds more. Experiments are now being conducted to determine if it will be wise to flash red lights to all directions for a few seconds on the change of lights in order to bring all traffic to a stop for the change.

Traffic at a busy junction in Leeds is now controlled by an electric signalling device showing three lights at each of four pillars placed at the corners. The device shows alternately red, for "Stop"; amber, for "Caution"; and green, for "Go." The periods of the various lights can be varied to suit the traffic needs, but at first the red and green lights were shown for 28 seconds, and the amber light for two seconds.

A "Safety First" Conference.

An industrial congress organised by the Home Office and the National "Safety First" Association was held at Caxton Hall, Westminster, on Tuesday last. The congress was opened by the Duke of York, and the chairman was Sir Gerald Bellhouse, C.B.E., H.M. Chief Inspector of Factories. Papers on "The Value of Safety Work in Industry" were read by Mr. E. J. Fox (Stanton Ironworks Co., Ltd.) from the employers' point of view, and by Mr. George A. Isaacs (National Society of Operative Printers and Assistants) from the operatives' point of view. A luncheon at St. Ermins followed, at which Sir William Joynson Hicks, Bt., M.P., presided. In the afternoon at the Home Office Industrial Museum, a paper on "Machinery Design, from the Safety Standpoint," was read by Sir Alfred Herbert, K.B.E.

Fatality.

Samuel Dickinson, of Mossley, Manchester, received a fatal electric shock whilst employed at the Stamford Mill on March 15th. Ernest Marsden, a carder, noticed something wrong with the electric lights, and glancing through the window into the motor room saw Dickinson lying on the floor. Artificial respiration was applied without success. It is thought that the deceased came into contact with a "live" part of a 350-h.p. motor.

New Type of Tramcar.

A tramcar of a new pattern has resulted from the joint efforts of the J. G. Brill Co. and the Westinghouse Electric and Manufacturing Company, U.S.A., to bring street-railway vehicles into line with modern practice in transportation. The body of the car was built by the Brill Co., and the new type of drive, a distinct departure from former street-railway practice, was developed by Westinghouse engineers. The floor of the new car is four inches nearer the ground than that of its predecessors, and it lies on a horizontal level from end to end. The new "W-N" drive is said to be the most compact gear ever devised for traction, and the ordinary low-speed 600-volt motors are replaced by small high-speed 300-volt motors operating two in series on 600 volts. The reduced dimensions of these motors make possible the use of wheels with a diameter of only 22 inches, whereas 26-inch wheels were formerly required. Noise has been eliminated, and by supporting the motors on springs the hammer blows at rail joints have been reduced. Sealed Timken bearings add to the quietness of the operation.

A wide expanse of glass in both the front and side windows affords an unobstructed view, in the interests of sight-seeing riders, and their comfort is enhanced by soft leather upholstered seats.

B.E.S.A. Publications.

The British Engineering Standards Association has issued a British Standard Specification (No. 321—1928) for General Grey-iron Castings, Grades A and C. It covers two grades of grey-iron castings for general engineering work. Provision is made for both transverse and tensile tests, and the engineer or purchaser must state at the time of the inquiry whether he requires tensile or transverse tests, or both. Three sizes of test bars, small, medium and large, have been standardised and are related to the main cross-sectional area of the castings or castings represented. Where the design of the castings permits, cast-on test bars may be specified. The number of transverse and tensile tests is based on the weight of the castings. In the case of a test piece failing to fulfil the test requirements, the additional tests to be carried out before the casting or batch of castings are accepted or rejected are clearly laid down. The specification includes appendices giving a concise summary of the testing requirements, a note on the method of calculating the modulus of rupture, and curves showing the minimum breaking loads to be obtained in cases where the transverse test bars as cast are slightly over or under the standard diameter.

The 1928 edition of the Index to British Standard Specifications and Reports has just been issued. It is a complete subject index which, in view of the large number (over 300) of British Standard Specifications now available, some of which include provisions for several articles or materials, will be of much assistance to those purchasing engineering and allied material, apparatus and machinery. A numerical list of the specifications is also included. The list, which covers 30 pages, shows the wide range of subjects covered by the British Standard Specifications. Copies of the above publications are available from the Publications Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1, price 1s. 2d., post free.

Illumination Design Course.

A five-day illumination design course is to be held at the Lighting Service Bureau, London, from April 30th to May 4th. It is intended to make this course much more comprehensive than any that have preceded it. The course will be of a rather more advanced character, and special attention will be given to the practical solution of problems. The lectures will, in every instance, be different from those given previously, and advantage will be taken of the new demonstration rooms which have recently been completed. Visits will be paid to factories, to study lighting conditions on site, and it is hoped to arrange for an inspection of the lighting arrangements of a London theatre; an opportunity will also be afforded to inspect shop lighting and street lighting.

The course may be attended by any member of the electrical industry, whether on the supply, wholesale, contracting, or manufacturing side, and applications should be made to the Lighting Service Bureau for reservation of places.

Central England Electricity Scheme, 1928.

The Central Electricity Board has caused the above scheme to be published, and copies of the scheme and a volume of particulars supplementary thereto can be obtained from H.M. Stationery Office, Kingsway, W.C., and George Street, Edinburgh, prices 1s. 6d. and 3s. 6d. each respectively (see our advertisement pages to-day). An account of the scheme appears on p. 529.

Electricity Charges in Wandsworth.

At a meeting of the Wandsworth Borough Council on March 20th it was decided to make application to the Minister of Transport for a revision of the prices and methods of charges which the County of London Electricity Supply Co., Ltd., was authorised to make for electricity in the borough.

High-Pressure Demonstrations at Hollinwood.

An interesting series of demonstrations was carried out at the works of Messrs. Ferranti, Ltd., on Monday last, in the presence of a number of distinguished engineers, including representatives of the Central Electricity Board. A high-voltage "surge generator" was demonstrated in operation, producing surges having maximum values up to 400,000 volts. These surges may be single impulses of steep wave fronts, or highly-damped oscillations, or any other desired form of transient. With this apparatus any form of surge or high-voltage disturbance on a line or cable may be reproduced for testing and experimental work by adjusting the circuit constants. The generator consists of twelve high-voltage condensers of 0.03 microfarad each. The condensers are charged up through thermionic rectifying valves by means of a high-voltage transformer.

The surge generator was demonstrated discharging across sphere and needle point gaps. The nature of this discharge is entirely different from a high-voltage 50-cycle discharge, and although considerably less than a micro-second in duration, it is intensely luminous and extremely noisy. The current at the instant of discharge runs into thousands of amperes. This generator is at present being extended to give a maximum surge of 1,000,000 volts; the whole of the apparatus was designed and constructed by Ferranti engineers.

The damage caused to transformers by surges and travelling waves is generally due to the comparatively high inductance of the transformer windings, which tends to prevent the surge discharging itself through the windings to earth and causes it to build up on the end turns. If, therefore, a surge is sent into a transformer winding, its capacity for damage may be estimated by measuring the increased voltage stress between the end turns. The next experiment was a demonstration of the effectiveness of the "Ferranti surge absorber" in reducing this risk. First, a surge was sent directly into the transformer winding; a small sphere spark gap connected across the end turns of the winding served to measure the resultant voltage stress in the transformer. The surge absorber was then connected in circuit between the surge generator and the transformer, and the test repeated exactly as before. The ratio of the voltage across the end turns, with the absorber in circuit, to the corresponding voltage without the absorber in circuit, is known as the absorption coefficient, and is a measure of the effectiveness of the surge absorber. In the demonstration the value of the absorption coefficient actually measured was 0.1; in other words, the surge absorption reduced the stress on the transformer due to the surge to 10 per cent. of the original value.

The relative protection afforded by electrostatic end rings and end-turn insulation reinforcement in a high-voltage power transformer was the subject of another experiment. A three-phase, core-type transformer had been built, having windings constructed as far as possible to represent to scale a typical large 132-kV power transformer. One leg of this transformer was designed in accordance with usual practice, and was not provided with end rings. The second leg consisted of similar windings, but electrostatic end rings were fitted. In the third leg the insulation between turns and coils of the windings was designed scientifically in conjunction with the end rings to reduce to a minimum the voltage stress resulting from an incoming surge, and to give the greatest factor of safety under such conditions.

The demonstration was carried out by means of the surge generator previously described. Tappings were brought out from between sections and turns at various points throughout each winding, and the voltage distribution between turns and coils throughout the winding, resulting from a surge, was measured. It was demonstrated that these stresses were in the ratio of 14, 5, and 2 respectively for the three legs of the transformer.

A 132-kV condenser-type bushing, specially designed and constructed by Ferranti, Ltd., for the national scheme, was shown flashing over in air, and part of the works' high-voltage testing equipment, consisting of two 500-kV, 50-cycle testing transformers connected in cascade to give 1,000,000 volts r.m.s., or 1,400,000 volts crest value above ground, was shown in operation.

The Ferranti pilot-wire protective gear, using rectified currents, was also demonstrated under various conditions.

Tramways and Light Railways Association.

The *Journal* of the Association for March states that in view of the fact that the majority of the members of the Council will be actively engaged during the spring and summer in connection with matters relating to Parliamentary business, it has been decided not to hold the usual Summer Congress. The Association will hold a members' dinner in London instead during the autumn.

The thirty-first annual general meeting of the Association will be held at Caxton Hall, S.W., at 2.30 p.m. on Friday, April 13th, 1928.

Reinforced Concrete Poles on the Continent.

Some weeks ago, during the discussion of the paper read by Major T. Rich before the Overhead Lines Association on "French Regulations and Policy," the view was put forward that the use of reinforced-concrete as compared with wood poles for power lines in general was little more than "a stunt"; experience had shown that no British maker of ferro-concrete was prepared to quote a commercial price for what might be termed an uncommercial proposition. In point of fact, the development of quick-hardening and high-compression cement, together with the supply of high-tensile steel at prices comparable to those for normal commercial bars, has given a great fillip to the use of such poles, and the increased economic radius of distribution resulting from decreased weight has enabled many poles to be made in factories under skilled supervision, thus removing the doubts that some might feel on the score of reliability.

In reply to an inquiry on the subject, some particulars with regard to the use of reinforced-concrete poles for power lines in France have been kindly furnished by the president of the Syndicat des Constructeurs de Poteaux en Ciment Armé, of Paris, the trade society for the new industry which has grown up there. He states that concrete poles have been made in France for 25 years; last year 125,000 were so made, the record for any year, and at present there must be about 700,000 to 800,000 in use. Concrete has been used for a number of lines operating at 60,000 volts for 15 years. Moulded poles (which are used very largely for distribution work) have not so far proved to be suitable for lines at 120,000-150,000 volts. Centrifugal poles have been made in France for the last two years, both on a French and on a German system; some poles have been erected recently which are 32 metres (about 105 feet) long. There must be nearly 500,000 concrete bases for wood poles in use.

The above particulars give some idea as to the extent to which rural electrification has been carried on in that country. Some of the earliest development was carried out by cement makers in the Dauphiné, who doubtless realised that a neat concrete power-line pole was a standing advertisement of the value of cement.

France, with so many years of experience to guide her, has put reinforced concrete on a par with steel as regards the factor of safety under wind pressure; it is to be hoped that the Electricity Commissioners at home will profit by the experience of our friends across the Channel and will not, by continuing to specify a factor of safety of 3½ (as against 2½ for steel), put an obstacle in the way of what could be a sound industry employing British materials and British labour.

A Large Power Station.

The new generating station of the New York Edison Company, which is being erected on the East River and is now one-tenth completed, will eventually house under one roof nine generating sets whose total capacity will reach almost 1,250,000 kilowatts. The station is designed to help to meet increases in the consumption of electricity until 1940. The cost of the completed structure is expected to exceed one hundred million dollars. Two generators, with a capacity of 60,000 kW each, are now in operation; the next machine, being built by the General Electric Company, will have a capacity of 160,000 kW, and will be assembled at the station. Through the use of travelling coal-handling towers along the river, the station will be able to unload coal directly from ocean-going vessels at the rate of 500 tons hourly, and will consume 8,000 tons of coal every day when finally completed.

"Twenty Years After."

A year or two ago a firm of electrical contractors was asked to quote for the overhaul of a theatre installation in Glasgow. As a preliminary, a foreman was sent to make an inspection of the existing wiring. In the course of his investigations he followed a certain run of conduit to where it disappeared into a wall. There the trail ended. He was unable to get to the other side of the wall to find out what was happening there. There was a door near by, but it was locked, and the key of it was lost. It had never been opened in the memory of anyone, from the manager down to the call-boy.

By this time curiosity was excited. What awful mystery lurked behind that locked door? What dusty horror awaited discovery there? The manager had the door forced.

It proved to be the door of a "bill room," and from the date of the last poster lying there, it had never been used since 1906. No difficulty in ascertaining that—for, in a pendant, a 16-c.p. carbon lamp was burning brightly. Somebody had left the switch on when the room was shut up twenty years before; and for all that time that lamp had bravely done its duty, wasting its brilliance on the desert air of a forgotten room—at 60 watts! . . . The manager, a Scot, of course, was carried fainting from the scene.

History does not relate the make of the lamp, and so some manufacturer loses a record advertisement.

International Commission on Illumination.

In September next an important meeting of the International Illumination Commission, which was formed in 1900 and includes both gas and electrical interests, is to be held in the United States. The objects of the Commission are the study of all subjects bearing on illumination and the cognate sciences, and the establishment of international agreements in illumination matters.

There are at present National Illumination Committees in Austria, Belgium, France, Germany, Great Britain, Holland, Italy, Japan, Switzerland, and the United States of America.

For the first time in the history of the Commission, a British president has been elected, Mr. C. C. Paterson, O.B.E., director of the Research Laboratories of the General Electric Co., Ltd., Wembley, having been unanimously voted president at the Bellagio meeting in September, 1927. His portrait appears on p. 517.

The Commission has already established an International Standard of Light, and the following subjects are now being dealt with, to which will be added from time to time other important matters associated with the study and practice of illumination engineering which are ripe for international consideration: Vocabulary, Definitions and Symbols, Factory and School Lighting, Automobile Headlights, Heterochromatic Photometry, Street Lighting, Signal Glasses, Diffusing Materials, Photometric Test Plates, Photometric Accuracy, &c., Light Flux Distribution, Daylight Illumination, Kinema Lighting, Fundamental Research on Glare, and Colorimetry.

The British National Illumination Committee, which is closely associated with the Sectional Illumination Committee of the British Engineering Standards Association (the membership being practically identical), and which will be responsible for nominating delegates to represent the British viewpoint and British interests, is very anxious to secure adequate representation at these meetings. It is hoped that the delegates will include representatives of the Government Departments, the Municipalities, the National Physical Laboratory, the electrical industry, the gas industry, and the principal associations interested in illumination matters, and an urgent appeal is being made to those bodies to provide the representation desired. Mr. Buckley, of the National Physical Laboratory, Teddington, who is the secretary of the British National Illumination Committee, will gladly furnish full particulars.

20,000-Volt Shaft Cables in South African Gold Mines.

A correspondent informs us that, on the recommendation of Mr. W. Elsdon Dew, their consulting electrical and mechanical engineer, the Rand Mines-Central Mining Group have taken an important step towards improving the efficiency of electrical transmission in the gold mines under their control. Hitherto these mines have received their supplies of electrical energy from the Victoria Falls and Transvaal Power Company, whose standard distribution pressure of 20,000 volts has been transformed down to 2,000 volts at the top of each mine shaft. Transmission down the shaft has been effected by means of three-core 2,000-volt paper-insulated, lead-covered and armoured cables, in the manufacture of which a special draining process has been included. The object of this draining was to prevent the creation of dangerous hydrostatic pressures within the lead sheath at the feet—and the weakening of the dielectric at the top—of the vertically installed cables due to the "bleeding" downwards of the paper-impregnating compound. Shaft cables of this class have become known as being of the "drained type."

The increased demand for electrical power below ground and the progressive deepening of the mines have frequently necessitated the use of a dozen or more heavy shaft cables in parallel, to serve large power units installed some thousands of feet from the surface. Highly valuable space in the shafts has thus been occupied by these multiple cables, and the transmission losses, in view of the high load factor of gold-mining operations, have grown to an alarming extent.

From time to time the possibility of solving both these problems, by raising the voltage of the shaft cables, has been examined by the mine engineers, who have realised, for instance, that one cable at 20,000 volts would more efficiently do the work for which ten cables at 2,000 volts are now employed. No progress in that direction could, however, be made so long as the above-mentioned draining process was an essential feature in the manufacture of shaft cables, because it was feared that the consequent admission of air pockets within the dielectric mass would jeopardise the life of such "drained" cables when operated at the higher voltage.

Improvements in the design and manufacture of extra-high-pressure cables recently encouraged Mr. Elsdon Dew to invite tenders from leading British, German, and American cable makers, with the result that an important contract has now been placed with Messrs. W. T. Glover & Co., Ltd., of Manchester, for about 15,000 feet of 20,000-volt, three-core, paper-insulated shaft cable made under their patented processes which enable them to produce non-bleeding extra-high-pressure cables without employing any draining process.

This cable is of the belted type, provided with a Glover patent test sheath under the lead sheath which is to be hydraulically pressure tested before dispatch from the makers' works. It will be installed, under Messrs. Glover's supervision, in one of the shafts of the Crown Mines, Ltd., Johannesburg, where the electrical centre of gravity of a load of about 6,000 kVA happens to be about 7,000 feet from the top of the shaft. At this remote centre the transmission voltage will be reduced to the operating pressure of 2,000 volts by means of specially designed transformers which have been ordered from the Metropolitan-Vickers Electrical Co., Ltd., who are collaborating closely with Glovers (for whom they act as agents in Johannesburg).

Important economies are expected to accrue from this installation, which will accordingly be watched with considerable interest by many engineers faced with similar problems. It is believed that this is the first time on record that mine engineers have felt justified in employing a pressure of 20,000 volts below ground with vertical shaft cables.

Thin Metal Sheets.

Sheets of metal, so thin that ordinary type can be read with ease through them, may find use in radio and phonograph reproducers. Ordinary diaphragms for this purpose are so heavy that they dampen some of the overtones and so coarsen the sounds. These thin metal sheets are the result of research by Dr. Carl Mueller, of the Charlottenburg Laboratory, near Berlin. His method of preparing them is to electroplate the metal on the surface of some soluble substance, such as rock-salt, and then dissolve away the support. A ring of thicker metal can be used to support the films, of which two and a half million would have to be piled to make a stack an inch high. Such films have been made of iron, nickel, gold, silver and platinum, and it is found that although the nickel is much less transparent to visible light than gold, it readily transmits the shorter ultra-violet rays. The films are very elastic, and will bulge out for as much as a tenth of their diameter without breaking. Another curious thing about them is their high electrical conductivity. A strip of film containing no more metal than a round wire one hundredth of a millimetre in diameter—scarcely visible to the naked eye—will carry enough current to light several lamps. If the same current were passed through the wire it would be instantly melted.—*Science Service.*

Finsbury Technical College Old Students' Association.

The 16th annual dinner of the Finsbury Technical College Old Students' Association was held at the Engineers' Club on Friday, March 2nd, when the chair was occupied by Mr. Francis H. Carr, C.B.E., F.I.C., president of the Association. About 70 members and friends were present. The loyal toast having been honoured, Professor Henry E. Armstrong, F.R.S., proposed the toast of "The Association." He said that at the Finsbury College, which Professor Ayrton and he had started to carry out the scheme of the City and Guilds of London Institute, the curriculum was arranged at the beginning to provide the chemist with some understanding of engineering and the engineer with some understanding of chemistry. He had no place for the "Chemical Engineer" as produced to-day. He was neither chemist nor engineer; engineering should be left to the engineer.

The Chairman, in reply, referred to the Professor as the "Father of Finsbury," who had consistently throughout his life striven for the things which were so important, namely, first principles. Finsbury men and women must continue to meet and to do what they could to further such principles.

Mr. E. W. Moss, M.I.Mech.E., A.M.I.E.E. (president-elect of the Association), proposed the toast of the guests in an excellent after-dinner speech. Dr. W. H. Eccles, F.R.S., responding, put forward the suggestion that someone should write a "History of Finsbury" while so many were still with them who would give particulars of the early days of the great institution.

Mr. R. W. Paul, M.I.E.E., in a humorous speech thanked Mr. H. P. Guy, of "Hadley," Station Road, New Barnet, Herts., the acting hon. secretary, and Messrs. Nadaud, Sack, and Price, for providing the music and contributing so much to the enjoyment of the evening.

Appointments Vacant.

Junior engineer (approx. £250) for the Crewe Corporation Electricity Department. Shift engineer for the Southport Corporation Electricity Department. Chief assistant engineer (approx. £2,500) for the Shanghai Municipal Electricity Department. Junior charge engineer for the Gravesend Corporation Electricity Department. Temporary meter reader and tester (63s.) for the Cheadle and Gatley U.D.C. Electrical engineer (£700) for the Stoke Newington Borough Council Electricity Department. (See our advertisement pages to-day.)

Institute of Industrial Psychology.

The recently issued 17th annual report and statement of accounts of the National Institute of Industrial Psychology indicates another record year in the activities of the Institute. As compared with 1926, the fees received for services have increased from £8,600 to £11,774 (37 per cent.), and the number of investigations undertaken for industrial concerns have increased from 25 to 32. During the year there was a growing demand for the application of the Institute's methods to the general organisation and layout of factories, while many inquiries were received from firms concerning the appointment of industrial psychologists to their permanent staffs. The number of members and associates increased from 984 to 1,138. The balance sheet for the year shows an expenditure of £17,860, which represents an excess over income of £134. The "liquid assets" at the end of 1927 amounted to £9,869, or £2,960 more than at the end of 1926.

Electric Power by Radio Beam.

According to Mr. Phillips Thomas, research engineer to the Westinghouse Electric and Manufacturing Co., if we could generate a wave of ten centimetres wave-length, we could reflect it exactly as we do light beams, and if we had a means of concentrating power in a reasonable amount in that beam—say a few thousand watts—it is quite within reason to expect that the air in the path would become ionised and be quite a fair conductor for electricity. We should then have the equivalent of a small copper wire, except that it would have no weight. It could be aimed at any desired point, without allowing for range. Two such beams, along parallel paths, could have their reflectors connected to the high-voltage terminals of a transformer, when a current would flow between the distant ends of the beams. If the two targets were metal plates connected to a transformer arranged to step-down the voltage, power could be developed at the receiving end. The power to be sent would not have any necessary relation to the size of the apparatus at the sending end, so that once we had the ionised paths, the power sent along them could be many times that required to ionise them. This power could be used to great advantage in cases where power was required in locations where the difficulty or expense of stringing wires would prohibit its delivery in the usual way.

Such an apparatus, besides its peace-time uses, would be of tremendous value in war-time, because it would be fatal to life to come into the path of the rays when energised at high voltage: in other words, it would constitute the "death ray" which has received so much attention from inventors. All this, he says, is quite feasible on one supposition, namely, that we have the ten-centimetre wave, with the necessary radio power behind it. This supposition is at present impossible of realisation, due to the limitations of vacuum tubes of the standard type. It is not, however, nearly as large a step from the present tubes to tubes of a proper type, as it was from no tubes to the present type. In fact, a type has been worked out on paper, and is soon to be tried out experimentally, which bids fair to give exactly what is required. Much more difficult things have been done, and Mr. Thomas predicts that this, in turn, will before very long be an accomplished thing.

Institution of Electrical Engineers.

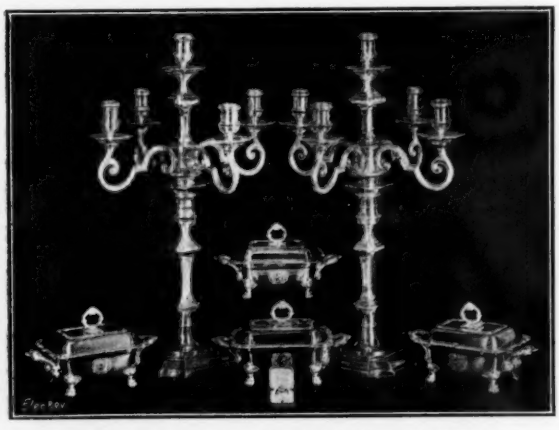
Coopers Hill War Memorial Prize.—This prize, which was founded by members of the Royal Indian Engineering College, Coopers Hill, in commemoration of members of the College who fell during the war, is awarded for the best paper on a professional subject selected by the Council of the Institution making the award. The triennial award falls this year to the Council of the Institution of Electrical Engineers, which has drawn up a list of subjects. Only corporate members of the Institution who were under 30 years of age on January 1st, 1928, are eligible to compete.

North-Midland Centre.—The following nominations have been made by the Committee:—Chairman: Mr. F. S. G. Hinings; vice-chairman: Mr. H. G. Fraser; hon. secretary: Mr. H. Cecil Fraser; committee: Messrs. J. Aylmer, H. Moss, T. B. Johnson, and J. N. Waite.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Three hundred employés of the Metropolitan-Vickers Electrical Co., Ltd., assembled at a complimentary dinner to Captain R. S. Hilton, held at the Midland Hotel, Manchester, on March 12th. Captain Hilton has recently resigned his position with the Metropolitan-Vickers Company to take up the managing directorship of the United Steel Companies.



Candelabra, &c., Presented to Capt. R. S. Hilton.

Sir Philip Nash, K.C.M.G., C.B., the chairman of the company, who acted as chairman at the dinner, proposed the loyal toast, and later Mr. McKinstry (director) proposed the toast of "Our Guest," and was supported by Mr. J. S. Peck (director and chief electrical engineer). Mr. Sam Ratcliffe, J.P. (chairman of the Works Committee) then presented Captain Hilton with a pair of silver candelabra, a set of silver sauceboats, and a diamond ring for Mrs. Hilton (who was present), subscribed for by 5,150 employés. Captain Hilton expressed gratitude on behalf of Mrs. Hilton and himself.

Dr. J. A. Fleming is to receive the honorary degree of Doctor of Engineering from Liverpool University in May on the occasion of the University's celebration of its 25th anniversary.

The Birkenhead Electricity Committee recommends the appointment of Mr. Frank A. Dracup, of Bradford, as motors and hiring superintendent, at a salary of £308 per annum.

The Douglas (Isle of Man) Electricity Committee has increased salaries as follows:—Mr. Bertram Kelly, borough electrical engineer, from £550 to £600; Mr. P. Bregazzi, mains superintendent, from £299 to £320; and Mr. R. M. Claque, station superintendent, from £331 to £350.

Mr. D. J. Barnes, of York, district telephone manager, has been transferred to the Nottingham district in succession to Mr. A. C. Haley, of Leicester, who is retiring. The new district manager for York is Mr. G. Edward, traffic superintendent, Reading.

Mr. R. H. Wells has resigned from the staff of the Pirelli-General Cable Co., Ltd., to take up an appointment with the Egyptian Government.

The Swinton and Pendlebury Urban Council has increased the salary of the electrical engineer, Mr. H. C. Busbridge, by £150 as from March 1st, with annual increments of £50 to £700.

The Bury St. Edmunds Town Council has increased the salary of the borough electrical engineer, Mr. S. E. Day, by £50 per annum.

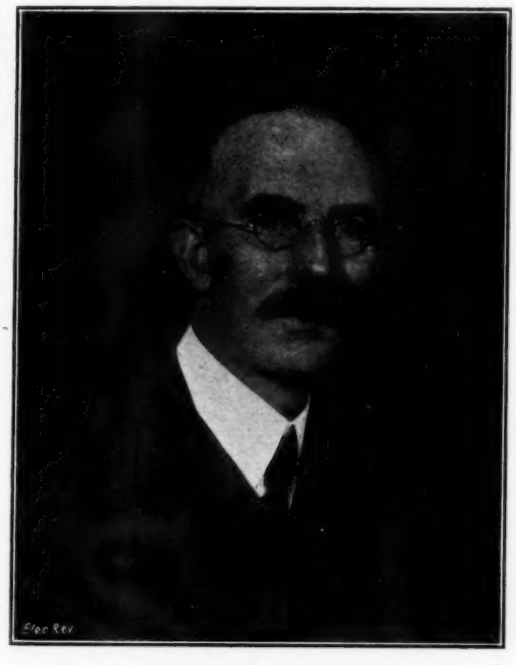
Mr. R. Boulter, C.M.G., Commercial Secretary at Tokio, will attend at the Department of Overseas Trade during next week. United Kingdom manufacturers or others interested in Japanese trade may interview Mr. Boulter by appointment. (Reference D.O.T. 443/1.)

Mr. G. T. Garwood, B.Sc., A.M.I.E.E., has been appointed resident manager of the West Hampshire Electricity Co., Ltd.

Mr. Dawson Thomas, A.M.I.E.E., has been appointed engineer and manager of the Abertillery municipal electricity undertaking, in succession to Mr. M. J. Mortimer.

We have much pleasure in giving herewith a portrait of Mr. CLIFFORD C. PATERSON, O.B.E., President of the International Commission on Illumination. Mr. Paterson's early training for his profession covered a wide range; after three years' apprenticeship in the workshops of Messrs. George Wailes & Co. and one year in the drawing office, followed by six months as a fitter with the Mirrlees Watson Company, Glasgow, he spent one year at Faraday House, and one year with the Maschinen-Fabrik Oerlikon. In 1903 he was placed in charge of the electrotechnical (particularly alternating current) and photometric work at the National Physical Laboratory, and was responsible to the director of the Laboratory for the building-up of this department, and for the direction of the research and test work in it from its beginning. This included the design and equipment of the electrotechnical and photometric buildings, the development of special precision methods of measurement, and the evaluation of the necessary fundamental units. Shortly after the outbreak of war he was responsible, with Dr. J. W. T. Walsh, for the inception and development of the Paterson-Walsh electrical height finder, which gave automatically a record of the heights of aircraft for use in anti-aircraft gunnery. Mr. Paterson joined the General Electric Co., Ltd., in 1919 to establish, and act as director of, research laboratories to co-operate in technical developments with the staffs of the factories and departments of the company; these laboratories started with a personnel of about 12, which has now grown to about 220. The buildings at Wembley took several years to design and construct, and were opened in 1923; they have a floor area of about 80,000 sq. ft., and are at present undergoing further extensions. Mr. Paterson has a staff to co-operate with him of which he must be proud. Amongst the many subjects of research undertaken at the G.E.C. research laboratories, illumination and all things associated with it have a prominent place. Such an organisation has exceptional facilities for carrying out pioneer work, both in measurement and research, and the opportunity has not been missed. Mr. Paterson has had the satisfaction of helping to apply the work he did at the N.P.L. to practical everyday use in industry, not only in the national, but in the international sphere.

Mr. Paterson has many contacts with engineering and science outside the immediate work of his laboratories; he has been

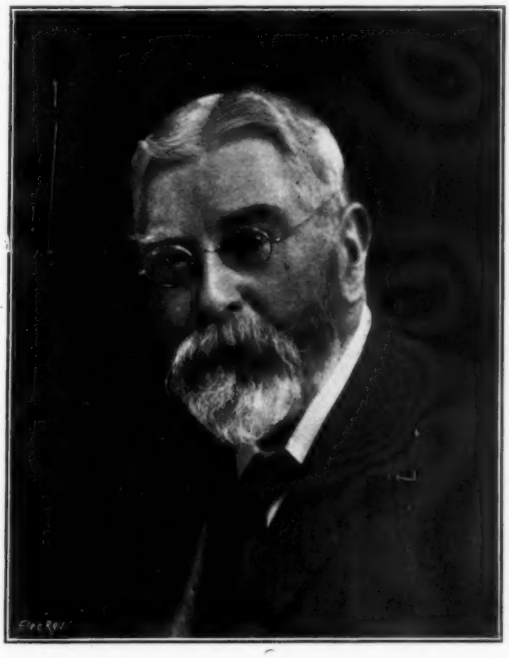


Mr. Clifford C. Paterson, O.B.E.,
President of the International Commission on Illumination.

vice-president of the Institution of Electrical Engineers and of the Institute of Physics, and is on the Councils of many research and engineering associations. In the sphere of illumination he is chairman of the Illumination Committee of the Department of Scientific and Industrial Research, with which the National Physical Laboratory collaborates closely. He is a member of the General Board of the N.P.L., and is chairman of the Street Lighting Committee and the Electric Lamp Committee of the Engineering Standards Association. He is vice-president of the Illuminating Engineering Society, and after being for 15 years honorary secretary of the International Commission on Illumination, he was last autumn elected president of this Association. It falls to his lot to preside at the sessions in the United States next September, of which particulars are given in our "Notes" to-day, and it is to be hoped that a large contingent of British representatives will support him on that occasion.

Mr. W. CARMICHAEL, president of the Blackburn Chamber of Commerce, has been elected representative of the Chamber on the Mid-Lancashire Electricity Advisory Board.

Obituary.—MR. J. P. HOOPER, M.I.E.E.—Mr. J. Pitman Hooper, chairman of Hooper's Telegraph & India Rubber Works, to whose death, in his 81st year, we referred in our last issue, was the son of Mr. William Hooper, an electrical engineer who founded the original company and continued as its manager until the year 1878. On his father's death, Mr. J. P. Hooper became manager of the business, and when it was reconstructed under its present title in 1894 he became managing director. He was educated at Brighton, Neuweid-on-the-Rhine, and Vevey, Switzerland, and commenced his professional career in his father's telegraph and



Elliott & Fry] [*London.*

The late Mr. J. P. Hooper.

rubber works, then at Mitcham Common, assisting in the manufacture of Hooper's rubber core for submarine cables which obtained the only gold medal awarded to English telegraph cables at the Paris Exhibition of 1867. From 1865 to 1871 he was engaged upon the manufacture of Hooper's core for the Ceylon-India cable, Persian Gulf cable, the Anglo-Danish, Anglo-Norwegian, Moen-Bornholm, Aland, Shetland, Hong Kong-Shanghai, and Nagasaki-Vladivostock cables, and accompanied the expedition for the laying of the last-mentioned of these. From 1872 to 1875 he superintended the manufacture of cables laid from Para, Pernambuco, Bahia, Rio de Janeiro, and the Cienfuegos-Santiago cable for the Cuba Submarine Telegraph Co. At the time of the reconstruction the works were removed to Millwall Docks, London, and the offices, which had been in Lombard Street, E.C., are to-day in King William Street, E.C. After this, while he was managing director, the company executed numerous contracts for H.M. Admiralty, the War Office, India Office, the Cuba Submarine Telegraph Co., the Amazon Telegraph Co., and made underground cables for China and elsewhere re-sheathed over 900 miles of Hooper's core that had been upwards of 35 years in use, and in recent years had been carrying out a large volume of work for various authorities and well-known companies. Mr. Hooper was created a Chevalier of the Order of the Rose of Brazil by the late Emperor. He became chairman of Hooper's Company in 1911, and held that position until his death. He was taking an active part in affairs until the end of last year. He married in 1875, Elizabeth, daughter of Mr. John Wood, of Sheffield, who survives him with two daughters and five sons. The two elder sons have been associated with their father in the business for many years, and are still engaged, Mr. J. F. W. Hooper as a director and general manager, and Mr. W. A. C. Hooper as a director and engineer. The interment took place on Friday afternoon last at St. Nicholas' Parish Church, Tooting.

MR. S. MAKOVSKI.—The death occurred suddenly on March 9th, in his 88th year, of Mr. Stanislaus Makovski, who was formerly head of the firm of Tamplin & Makovski, electrical engineers, of Redhill.

Will.—The late Mr. R. PERCY SELLON left £105,932 gross and £97,999 net personalty. He leaves £1,000 to his executors for the societies, institutions and charities with which he was connected.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Animated Displays, Ltd.—Private company. Registered March 12th. Capital, £100 in £1 shares. Objects: To carry on the business of designers and manufacturers of and dealers in electric, revolving, changeable, movable, coloured, illuminated, and other signs, lettering, pictorial designs, devices, &c. The subscribers (each with one share) are:—S. Alexander, Park Lane Hotel, W., Lieut.-Col. R.C., U.S. Army; S. Jarratt, 2, Baytree Road, Brixton Hill, S.W.2, electrical engineer. Solicitors: Cooper, King & Co., 6, New Court, Lincoln's Inn, W.C.2.

Hector Russell & Co., Ltd.—Private company. Registered March 9th. Capital, £1,000 in £1 shares. Objects: To carry on the business of dealers in wireless apparatus of all kinds, &c. The directors are:—H. G. Russell, 19, Hamilton Street, Greenock, engineer; Mrs. C. K. Fairbairn, 11, Ardgowan Square, Greenock; J. A. Hildreth, 50, Brougham Street, Greenock. Qualification: 25 shares. Registered office: 19, Hamilton Street, Greenock.

Killamarsh and District Electric Supply Co., Ltd.—Registered March 10th. Capital, £6,000 in £1 shares. Objects: To carry on the business indicated by the title. Minimum cash subscription: 7 shares. The first directors are:—G. A. Bramall, Bridge Street, Killamarsh; W. H. Hardy, Birchlands, Killamarsh; J. W. R. Glover, 66, Station Road, Woodhouse (director of Joseph Glover, Ltd.); G. R. Gregory, The Schoolhouse, Killamarsh; J. Swindell, Vine Cottage, Killamarsh; A. Topham, Lyndhurst, Killamarsh; H. H. Berresford, Duckmanton Lodge, Calow, near Chesterfield (commercial manager of Staveley Coal & Iron Co., Ltd.). Qualification: £50 shares. Secretary: M. Hall. Registered office: The Grange, Killamarsh, Derbyshire.

Household Electrical Supplies Co., Ltd.—Private company. Registered March 9th. Capital, £20,000 in 15,000 10 per cent. preferred ordinary shares of £1 and 100,000 deferred ordinary shares of 1s. each. To adopt agreements with the Carlisle Investment Trust, Ltd., and Robert Hornby & Co., Ltd., and to carry on the business of civil, mechanical, electrical, chemical, hydraulic, pneumatic, gas, aerial, mining, constructional, heating, lighting, ventilating and consulting engineers, electricians, &c. The subscribers (each with one prefered ordinary share) are:—E. C. Mead, 39, Stanley Road, Woodford, E.18, accountant; H. C. Dawson, 243, Union Street, S.E.1, clerk. Registered office: 77, Dean Street, Soho, W.

Liverpool Casements, Ltd.—Private company. Registered March 14th. Capital, £1,000 in £1 shares. Objects: To carry on the business of metal casement manufacturers and ornamental iron workers, electrical, steam, petrol, marine and mechanical engineers, makers of electric generators and motors, repairers and rewinders of electrical machinery, makers and suppliers of radio instruments, &c. The first directors (to number not fewer than two or more than five) are:—J. Jump, 1, Dawlish Road, Wallasey, engineer (chairman); T. A. Jones, 44, Romer Road, Liverpool, constructional engineer; F. Wilde, 4, Marmaduke Street, Edge Hill, Liverpool, electrical engineer (managing director). The above are life directors. Registered office: 3, Back Towerlands Street, Edge Hill, Liverpool.

Supremus Specialities, Ltd.—Private company. Registered March 15th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers and manufacturers, workers and dealers in electricity, motive power and light, &c. The first directors are: E. C. Rooker, 409, Sutton Road, Erdington, Birmingham; J. Ward, "Oakdene," 189, Alcester Road South, King's Heath, Birmingham; J. E. Ward, The Cottage, Desford Lane, Kirby Muxloe, Leicestershire (all permanent, subject to each holding 100 shares). Qualification: 100 shares. Solicitor: F. S. Saville, 23, Temple Row, Birmingham.

Shore Manufacturing Co., Ltd.—Private company. Registered March 13th. Capital, £2,500 in £1 shares. Objects: To acquire (1) the business of an electrical and radio manufacturer and manufacturer's agent carried on by G. C. Shore at 28, Newman Street, W., and (2) the business of electrical and radio manufacturers and agents carried on by C. T. O'Callaghan and H. F. Pattinson as the Calpat Manufacturing Company, of 30, Great James Street, Bedford Row, W.C. The first directors are:—H. L. Foden-Pattinson, 141, Bedford Court Mansions, Bloomsbury, law student; S. W. Batson, 16, Richmond Road, East Finchley, N.2, clerk. Secretary: Ada Marshall. Registered office: 30, Great James Street, Bedford Row, W.C.1.

Official Returns of Electrical Companies.

R. A. Evans, Ltd.—Further charge on certain property in Leicester, dated February 24th, 1928, to secure £2,000. Holders: Leicester Permanent Building Society.

Geoffrey Boulding, Ltd.—E. C. Williams, of 107, Mortimer Street, Herne Bay, ceased to act as receiver or manager on February 28th, 1928.

London Power Co., Ltd.—Trust deed dated February 24th, 1928 (supplemental to trust deeds dated April 15th and November 19th, 1926) to secure £11,000,000 (inclusive of £7,000,000 already registered). Property charged—the company's undertaking, property, assets and revenues, present and future. Holders: Law Debenture Corporation, Ltd., 24, Old Broad Street, E.C.

Electromobile Engineering Co. (West Bromwich), Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1927. 482 shares taken up. £482 paid. Mortgages and charges nil.

Almondsbury and District Electric Supply Co., Ltd.—Capital, £3,000 in 1,000 preference and 2,000 ordinary shares of £1 each. Return dated December 15th, 1927. 1,000 preference and 1,115 ordinary shares taken up. £2,115 paid. Mortgages and charges nil.

Gas and Electricity Development Co., Ltd.—Capital, £2,000 in 1,000 preference shares of £1 each and 20,000 ordinary shares of 1s. each. Return dated December 31st, 1927. All shares taken up. £2,000 paid. Mortgages and charges nil.

Reed, Evans & Co., Ltd.—Capital, £100,000 in £1 shares. Return dated December 31st, 1927. 92,292 shares taken up. £6,576 paid (being £1 per share on 657 shares and 4s. per share on 29,595 shares). £85,716 considered as paid (being £1 per share on 62,040 and 16s. per share on 29,595 shares). Mortgages and charges nil.

Stearn Electric Co., Ltd.—Issue on February 23rd, 1928, of £200 debentures, part of a series already registered.

Chagford and Devon Electric Light Co., Ltd.—A. Waycott, of Victoria Street, Paignton, was appointed receiver by Order of Court dated January 31st, 1928, in place of R. Waycott.

Radio Equipment Co., Ltd.—C. Latham, of 78, New Oxford Street, W.C., ceased to act as receiver or manager on March 6th, 1928.

Essaness Radio and Electrical Co., Ltd.—Particulars filed of £500 debentures authorised February 5th, 1928, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Hartley Engineering Co., Ltd.—Particulars filed of £1,000 debentures authorised March 3rd, 1928, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £200.

E. & C. Gates, Ltd.—Satisfaction to the extent of £443 12s. on February 29th, 1928, of debentures dated April 7th, 1925, securing £4,000.

S. B. Saunders, of 26, Park Row, Nottingham, ceased to act as receiver or manager on March 5th, 1928.

Winfield & Reeves, Ltd.—Particulars filed of £200 debentures authorised February 20th, 1928, charged on the company's property, present and future, including uncalled capital (subject to debenture dated July 8th, 1927), the whole amount being now issued.

Priorsells, Ltd.—Debenture dated March 1st, 1928, to secure £600 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. D. Williamson, c/o the Winchester Trust & Agency, Ltd., 110, Cannon Street, E.C.4.

Electrical Importers (Hull), Ltd.—Capital, £205 in £1 shares. Return dated December 10th, 1927. Four shares taken up. £4 paid. Mortgages and charges: £1,000.

H.E.C. Electric Co., Ltd.—Capital, £1,000 in 400 preference and 600 ordinary shares of £1 each. Return dated December 16th, 1927. 170 preference and 202 ordinary shares taken up. £172 paid on 170 preference and two ordinary shares. £200 considered as paid on 200 ordinary shares. Mortgages and charges, nil.

Electro-Plant, Ltd.—Capital, £1,000 in £1 shares. Return dated December 30th, 1927. Two shares taken up. £2 paid. Mortgages and charges, nil.

Milldale, Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1927. 740 shares taken up. £749 paid. Mortgages and charges, nil.

City Notes.

Metropolitan-Vickers Electrical Co., Ltd.

The chairman (Sir Philip Nash) presided at the annual meeting on March 16th, and in presenting the report and accounts said that the general reserve account had again been increased by £25,000, and now stood at £550,000. The profit for the year was £254,748, as against £273,646 for 1926, a decrease of £18,898. They regretted Captain Hilton's resignation. During the nine years of his connection with the company it continued to make increasing progress in engineering, manufacturing, research, and the arrangements for the selling of its products all over the world. The good relations which had existed between the management and the employés were largely due to his personal efforts. Following on the policy adopted last year of electing senior members of the staff to the board, Mr. J. S. Peck, the chief electrical engineer, had been elected a director. His election was a recognition of the importance of the technical side of the business. The control of the company had passed from Vickers, Ltd., and following that change of control Mr. Bernard D. F. Docker had been elected a director and deputy chairman. Sir M. W. Jenkinson had resigned from the board, and Sir E. Wyldbore Smith had been appointed a director. There had been a record output of finished products from the works during 1927, but although they had been very fully occupied, the result had been an inadequate profit. The year 1927 commenced with a very heavy order book, and during the year the company obtained new orders practically equivalent to its output, and therefore they started 1928 with a very satisfactory accumulation of unexecuted orders of practically the same amount as a year ago. The present order book consisted of about equal proportions of home and export business. Conditions in the home market had been subnormal for some time, *i.e.*, the demand for heavy electrical plant had been below normal, principally owing to the hold-up of power station development in the country, during the consideration and discussion of the Electricity (Supply) Act. Now that the Central Electricity Board was at work, the demand for heavy plant was bound to improve, but time must be allowed for that body to launch its schemes, and bring them into being. There were indications of an increased demand for electrical plant from home industries due to improved conditions. The demand in the home market, which undoubtedly was developing, had unfortunately attracted increased and severe foreign competition, and since the last annual meeting there had been a marked reduction in the average selling prices of electrical products in this country. This severe foreign competition in the home market not only had the effect of depressing selling prices, but if continued it would reduce the ability of British electrical manufacturers to obtain their proper share of the overseas market. The existence of foreign-made plant operating in prominent power installations in this country was apt to lead some buyers in the export market to conclude that the British manufacturer was not capable of supplying them with the most modern and efficient machinery. A British electrical manufacturer desiring to maintain his position in the front rank of competition must cater for a much greater variety of plant and equipment than had hitherto been necessary in Great Britain, because in the export market there was and had been a demand for larger units, higher voltages and generally equipment covering a much wider technical range than in this country. Due to the Central Electricity Board's activities, and to the developments undertaken by the more progressive municipalities and power companies, the most highly developed plant was now being called for. British manufacturers who had had the enterprise in the past to develop this class of plant in face of world competition were now threatened with a loss of the result of their enterprise by foreign manufacturers selling this plant in Great Britain at what would appear to be "dumping" prices. The British manufacturer had to depend, in order to maintain an economic load in his factories, on obtaining at least 50 per cent. of it in the overseas market. Any additional handicap added to the already great difficulties and intense competition at present existing, tended to reduce the volume of work obtained, and it was only by ensuring volume of work that the British manufacturer could hope to keep production costs and selling prices down. He saw no reason to expect any improvement in export prices, but he felt that they were threatened with a further period of reducing home prices. Throughout all markets the company had acquired a reputation for efficiency and reliability of product which was second to none. To maintain that position it possessed an engineering force of first-class ability and one of the finest research organisations in the country. On the production side its plant and machinery had been maintained in the highest state of efficiency, and it had a highly efficient staff of workers, of which no fewer than 862, or one in every 14, had been with the company for more than 20 years. The commercial organisation was operating with great enterprise and effect in the home and overseas markets. While the company was never stronger in every way, there was at present an entirely inadequate profit in prospect. With those considerations in mind the board had recommended a reduced ordinary dividend, whilst further strengthening the resources by contributing £25,000 to the general reserve. The best way to meet the excessive competition with which they were faced was by reducing selling prices; that could only be made possible by a reduction in working expenses. Therefore the remedy for the present state of affairs lay within the industry itself. So long as individual concerns continued to parallel each other's activities and developments, and thus maintain ever-increasing expenditure in competition, the present unsatisfactory state of affairs must continue. The situation called for co-operation in the industry by the elimination of avoidable competition, by the pooling of research, and concentration of engineering development, and manufacturing facilities, also by the standardisation of product. It was only by co-operation that the company and the industry could bring about a larger turnover, lower selling prices and a greater profit. In conclusion, he would refer to what had taken place in the change of control of the company since he last addressed them. Messrs. Vickers, Ltd., had sold the control of the company to the International General Electric Co. At this stage Mr. F. Dudley Docker came into the transaction, and the control now lay in his hands. Mr. Docker had had a close and intimate relationship with the company since 1918. He then had in view the formation of a consolidated electrical undertaking on the lines of similar undertakings existing in Germany and America. At that time Mr. Docker was instrumental in finding a million pounds sterling for the company, which put it into a financial condition to carry on its business and keep pace with the rapid developments in the industry. Shortly after his taking over control of the company in 1918, and too soon for any progress to be made in his scheme, Vickers, Ltd., purchased the Metropolitan Carriage, Wagon and Finance Co., and thereby acquired the control of Metropolitan-Vickers. Since 1919 Metropolitan-Vickers itself had made remarkable progress, but independently of the larger scheme that Mr. Docker had in his mind in those days. He had come back into the industry to lend his aid and use his unequalled experience and great influence in the pursuit of a policy of co-operation within the industry on similar lines to those which he was contemplating as far back as 1819. The reappearance of Mr. Docker in the affairs of the company was accepted with great satisfaction by the board and staff as an indication that the troubles and difficulties with which the industry had for years been surrounded would be actively and seriously tackled with the best chance of a successful solution. The permanent solution would not be reached until Great Britain possessed an electrical engineering corporation resting on sound foundations and so organised as to compare favourably with the undertakings in Germany and America.

The report and accounts were adopted.

Metropolitan Electric Supply Co., Ltd.

The annual meeting was held on March 14th. Mr. G. Balfour, M.P. (deputy-chairman), presided, and in moving the adoption of the report and accounts (*vide* ELECTRICAL REVIEW, March 9th, p. 432), he referred to the recent sudden rise in the quotation of the company's ordinary shares and said that he knew of no circumstance to justify it. He was not aware of any offer of purchase; if such an offer were ever made public intimation would be given immediately to counter gambling in the shares. Dealing with the question of prices, he said that reductions had been long delayed owing to the proximity of 1931, the former date of purchase by the L.C.C. Now that the uncertainty had been removed the London companies were able to consider the matter. The figures quoted in the Press did not exhibit a true comparison, but he could say that, so far as the company was concerned, a programme for a reduction of rates had long been fixed and was being adhered to. In the near future they were concentrating upon a two-part tariff, and they had decided to fix a "unit" rate of ¾d. in the London area. Reductions of charges in the London area already announced amounted to £55,000 per annum. The company now owned or controlled the authorised undertakings under the Paddington and Mid-London Orders. They controlled bulk supply in 480 sq. miles of the Western area outside the Metropolitan area, and in addition controlled the supply in the Brentford local district; the Uxbridge urban and rural areas; Chesham and Berkhampstead; Windsor and district; and Slough and district. The Windsor and Slough companies had been acquired since the close of last year's accounts. The company also gave bulk supplies to various undertakings and direct supplies under Provisional Orders in Acton, Hanwell, Southall and Norwood. During the year bulk supply was commenced to the Cookham and District Electricity Corporation and to the North Metropolitan Co. The Chesham company had been granted an order (now awaiting confirmation) for the extension of its area. The western area 22,000-V transmission had been augmented by a new feeder between Willesden and Ironbridge, and a western loop main had been completed to increase the reliability of supply to the Chesham Co., the Maidenhead Corporation, and the Colne Valley Co. A feature of the accounts for the last few years had been the expansion of revenue from the Western area; last year they sold 60 per cent. more energy in that area than in the London area, although the revenue was lower owing to the industrial nature of the supply. They would probably find that this year's revenue would be equal to that obtained from the London area. In conclusion, Mr. Balfour reviewed the accounts and referred to the activities of the London Power Co.

Vickers, Ltd.

The directors recommend a dividend of 8 per cent. on the ordinary shares. The last payment on the ordinary capital was 5 per cent. in 1922.

Marconi-Cable Merger.

Last week it was announced that the conferences between representatives of the Eastern and Associated Telegraph Companies and Marconi's Wireless Telegraph Co., Ltd., had resulted in a decision to recommend the fusion of the companies' interests. Later details of the proposals were issued. A holding company will be formed with a total capital of £53,700,000, arranged and divided as follows: £23,500,000 in 5½ per cent. cumulative preference shares (Cable Group £20,000,000, Marconi's £3,500,000); £21,200,000 in 7½ per cent. non-cumulative "A" ordinary shares (Cable Group £13,200,000, Marconi's £8,000,000); and £9,000,000 in "B" ordinary shares (Cable Group £3,150,000, Marconi's £5,850,000). The "A" shares carry one vote each and the "B" shares two votes per three shares. In the event of the dividend on the preference shares being in arrears, each ten of those shares will have one vote. This arrangement gives the Cable Group 56¼ per cent. of the voting powers, and Marconi's 43¾ per cent. While the whole of the Marconi capital is thus taken in, only the ordinary share capital of the Cable Companies is dealt with. They are thus left with the responsibility of their debenture and preference stocks to the following amounts:—Eastern Telegraph Co., Ltd., £2,000,000 4 per cent. debenture stock and a similar amount of 3½ per cent. cumulative preference stock; Eastern Extension, Australasia and China Telegraph Co., Ltd., £752,400 four per cent. debentures; Western Telegraph Co., Ltd., £818,675 four per cent. debenture stock. The last company guarantees the principal of and interest on £100,000 four per cent. debentures of the Pacific and European Telegraph Co. It is proposed that the Cable Group shall appoint 12 directors to the board of the new company and the Marconi Co. eight. The scheme, according to the report, "should be dependent on an agreement being made with the British Government and the Governments of the Dominions and India which will be satisfactory to the Cable Companies and to the Marconi Company."

County of London Electric Supply Co., Ltd.

The report for the year ended December 31st last states that at the close of the period the capital expenditure totalled £9,906,742. The profit for the year was £1,014,027, and the addition of £51,374 brought forward and £63,500 interest charged to capital (Barking Supply) makes available £1,128,901. After meeting debenture interest, &c., and taxation, £28,975 is carried to the contingency fund (London Electricity (No. 1) Act, 1925), £227,800 to reserve for depreciation (including sinking-fund contributions under the Act), and £15,000 to investment reserve account, leaving £631,238. After paying the preference and ordinary dividends a balance of £204,988 is carried forward. The final ordinary dividend is 4½ per cent., making 7½ per cent. for the year.

Applications for supply amounted to 38,432 kW, making the total at the end of the year 246,941 kW. The amount of energy sold rose from 145,714,062 kWh to 248,311,589 kWh, and the number of consumers supplied directly or indirectly increased by 17,494 to over 102,000. During the year the £500,000 first and £500,000 second debenture stocks were paid off and an issue of £4,250,000 5 per cent. debenture stock was made at £96 per cent. The issue was several times over-subscribed. The company's Bill providing for the extension of its powers and area of supply in Essex received the Royal Assent in July last. The company obtained a Special Order for Epping and District, and the mains are now being extended to that area. Under the South-East England Scheme the company's Barking and Wandsworth stations have been deemed "selected" stations. The company has acquired fresh interests in certain undertakings adjoining its southern areas of supply. Considerable reductions have been, and are being, made in the charges to consumers. The report mentions the death of Mr. R. P. Sellon, and the appointment of Lord Askwith to the vacancy thus created on the board. Meeting: March 27th.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The report for the year ended December 31st last shows that the connections rose from 657,451 to 687,559 h.p. The net profit amounted to £783,493, as compared with £576,421 in 1926. After paying debenture interest, and transferring £150,000 (against £75,000) to special depreciation and contingencies reserve, and £50,000 (against £25,000) to plant renewal and improvements reserve, there remains £362,028, to which is added £15,990 brought forward, making £378,018. The preference dividends are paid; a final dividend of 3½ per cent., making 6 per cent. for the year, is paid on the old ordinary shares; and a dividend at the rate of 6 per cent. from the due dates of instalments is paid on the new ordinary shares; leaving £43,206 to be carried forward. The year's capital expenditure totalled £169,056, representing mainly extensions to the h.p. and l.p. distribution systems. The issue of 770,000 ordinary shares offered to the holders of 5 per cent. preference and ordinary shares was largely over-applied for. The company's associate, the Cleveland and Durham County Electric Power Co. is promoting a Bill to authorise the extension of its area and for other purposes. After the ordinary meeting on March 27th a resolution approving the objects of the Bill will be submitted. The transfer of the staff to the company's new offices at Carliol House, Newcastle, was completed in December last.

Liverpool Overhead Railway Co.

The annual meeting was held at Liverpool on March 14th, Mr. M. H. Maxwell (chairman) presiding. The chairman said that when the Crosby tramway ceased working, the company lost its biggest customer for electricity, and in June last it ceased to generate its own electricity and was now obtaining its supply from Liverpool Corporation, which was cheaper. The arrangements were working satisfactorily, and would result in considerable economy. Reductions in staff, the purchase of cheaper power from the Corporation, and the fact that the company was now doing work previously let out on contract, had effected further economies. Owing to the great cost of erection and operating, it had been decided not to proceed at present with the construction of a station at the New Gladstone Dock. Referring to a suggestion that appropriations to the renewal fund should be discontinued, Mr. Maxwell said that the fund was the only one that the company had to cover structural depreciation, the renewal of rolling stock, &c. Besides unforeseen contingencies, the company would have to provide a new conductor rail over the whole line this year at a cost of £6,000. The report and accounts were adopted.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

The report for 1927 states that the connections increased during the year from 27,499 kW to 30,064 kW; the sales of energy amounted to 14,590,141 kWh. The net profit for the year was £43,869; a balance of £2,134 brought forward is added, making £46,003. As already announced, a balance dividend of 1s. 1.223d. per share is being paid on the ordinary shares, making up the standard dividend for the year (1s. 7.223d.); £15,513 is carried forward. The annual meeting is to be held on March 27th, and subsequently a resolution will be submitted providing for the capitalisation of £5,500 of the free reserves, and allotting it in the form of £1 ordinary shares to the present directors by way of extra remuneration for their services to the company in connection with the London Electricity (No. 2) Act and the London Power Co., Ltd.

Isle of Thanet Electric Supply Co., Ltd.

Presiding at the annual meeting, on March 14th, Mr. A. R. Monks (chairman) pointed out that the transport services provided £85,804 of the total revenue (£160,757). The increase in the lighting and power revenue was satisfactory. The capital expenditure during the year was £26,530; of this £20,230 was for the development of the electricity supply branch, and the remainder for additional motor-buses and the completion of the new garage. They were not contemplating the issue of new capital at present; extensions of the undertaking would be financed from the general reserve and depreciation account. In conclusion, the chairman reminded the shareholders that the concessions in Margate and Broadstairs expired in 1928 and 1941, respectively, at which dates the local authorities had power to purchase.

Woking Electric Supply Co., Ltd.

The balance on working for the past year was £40,885, and to this is added £1,474 brought forward, making £42,359. After meeting debenture charges, preference dividends, &c., there remains a balance of £26,382, which it is proposed to distribute as follows: To depreciation and renewals account, £10,000; to reserve account, £5,000; to change-over account, £5,000; to cost of licence, Provisional Order, &c., £514; to extinction of debenture issue expenses, £1,803; dividend of 10 per cent., free of tax, on the ordinary shares; carried forward, £1,344. The number of consumers rose from 3,877 to 4,387, and the energy sold from 3,968,805 kWh to 4,815,108 kWh. The system of supply has been successfully changed over from 100 to 50 cycles.

Waygood-Otis, Ltd.

The annual meeting was held on March 15th. Mr. H. C. Walker (chairman), who presided, said that during the year the company's factory had been busy producing additional escalators for the London Underground Electric Railways, and it was now engaged on 11 escalators for Piccadilly Circus station. The re-building and re-equipping of the factory at Falmouth Road had been completed, and it was now, according to its size, second to none in the Kingdom. The association with the Otis Elevator Company had proved most valuable. Interchange of views between the companies had led to the successful solution of many problems arising in connection with the lift industry. The report and accounts were adopted.

Automatic Telephone Manufacturing Co., Ltd.

The report for 1927, which was briefly reviewed in our last issue, shows that the profit rose from £161,497 to £171,359. The addition of £59,852 brought forward makes available £231,211. The allocations include £15,000 to general reserve (against £35,000), £30,000 to depreciation (against £40,000), and £40,000 to special reserve. The dividend is maintained at 10 per cent. The directors report that steady production was maintained throughout the year in the principal departments of the business. The death of Mr. James Taylor is recorded, and it is stated that Mr. John Lee, C.B.E., and Mr. G. W. Moore (manager of the company) have joined the board. The meeting was held on Tuesday last.

International Automatic Telephone Co., Ltd.

This company's report for 1927 covers much the same ground as that of the Automatic Telephone Mfg. Co. The profit for the year rose from £119,884 to £124,369; a balance of £38,583 brought forward is added, making £162,952. The dividend is again 10 per cent. During the year the authorised preference share capital was increased from £200,000 to £400,000 in accordance with an agreement made with Messrs. Theodore Gary & Co. (New York).

Bruce Peebles & Co., Ltd.

The profit for the year ended December 31st, 1927, was £25,508, as compared with £24,509. The addition of £6,812 brought forward makes available £32,320. The depreciation account again receives £5,000, and after the payment of the preference dividend the ordinary shares receive 10 per cent., as for 1926, leaving £5,967 to be carried forward. The report says that the transformer department is developing satisfactorily. Meeting: To-day (Friday).

American Cable Merger.

It was reported on Tuesday last that it had been decided to merge the Mackay Companies in the International Telegraph and Telephone Co., of New York, following on the recent acquisition by the latter company of All-America Cables, Inc. The combined assets affected by the merger are valued at about 225 million dollars (£45,000,000). The combine will control telegraph and telephone systems between Canada in the north and Argentina in the south of the American continent. Important developments are expected in the near future.

Clarke, Chapman & Co., Ltd.

The net profit for 1927 was £53,681, and after providing for depreciation and directors' fees, there is a balance of £39,750 (against £5,943 in 1926), to which is added £3,246 brought forward, making £42,996. It is proposed to pay a final dividend of 5 per cent. (making 7 per cent. for the year, against *nil* for the preceding year), leaving £7,022 to be carried forward.

Annual General Meetings.

On Tuesday last the annual general meetings of the British Insulated Cables, Ltd., the Midland Electric Corporation for Power Distribution, Ltd., and the Automatic Telephone Manufacturing Co., Ltd., were held. Reports of the proceedings will appear in our next issue.

Brompton and Kensington Electricity Supply Co., Ltd.

The directors have declared a final dividend of 10.706d. per share on the ordinary shares, making up the standard dividend for the year.

Bombay Electric Supply and Tramways Co., Ltd.

It is reported that the company's net receipts for the past year show a rise of from 70 to 72 lakhs of rupees. A dividend of 14 per cent. is recommended on the ordinary shares (as for 1926), and the staff and employés are to receive a bonus of one month's pay.

Robey & Co., Ltd.

The accounts for 1927 show a trading profit of £8,137, but after meeting debenture interest, &c., there is a deficit of £106. The previous year's loss was £38,235, and the accumulated deficit is £53,608.

Rangoon Electric Tramway and Supply Co., Ltd.

A final ordinary dividend of Rs. 1.4 annas per share, free of Indian income tax, is recommended, making Rs. 1 1½ annas for the year, as in 1926.

Elgin Electricity Supply Co., Ltd.

For the purpose of extending its plant, the company is to increase its capital by £10,000. A dividend of 5 per cent. is being paid from last year's profit of £1,821.

Anglo-Portuguese Telephone Co., Ltd.

A final dividend of 5 per cent. is recommended on the ordinary shares, making 8 per cent. for the year (against 7 per cent. for 1926).

Hadfields, Ltd.

A dividend of 5 per cent. is recommended on the ordinary shares, as compared with 2½ per cent. for 1926.

Eastern Telegraph Co., Ltd.

A final dividend of 2½ per cent., free of tax, has been declared on the ordinary stock, making 10 per cent. for the year, free of tax, the same rate as for 1926.

Globe Telegraph and Trust Co., Ltd.

A quarterly dividend of 5s. per share net has been declared on the ordinary shares.

Eastern Extension, Australasia & China Telegraph Co., Ltd.

A final dividend of 5s. per share, free of tax, has been declared.

Direct Spanish Telegraph Co., Ltd.

The board recommends a dividend for the year 1927 of 10 per cent. on the ordinary shares, free of tax. Four per cent. of this was paid in October last.

Atlas Light and Power Co., Ltd.

An interim ordinary dividend of 2 per cent. has been declared, as in 1927.

Bogota Telephone Co., Ltd.

An interim dividend of 5 per cent. has again been declared.

Swiss Company.

Swiss Electrical Industry Co., Basle, which is an investment undertaking, reports net profits of 3,060,000 fr. for 1927, as compared with 3,040,000 fr. in the previous year. The dividend is maintained at 8 per cent.

Stocks and Shares.

MONDAY EVENING.

BUSINESS continues to be exceptionally active, and the coming week will see one of the largest settlements of recent times. The Gilt-Edged Market has continued fairly active, with support for the long-dated issues, coupled with a fair amount of buying of Funding Loan and Victory Bonds on account of American investors, attracted by the yields, which are considerably higher than can now be obtained upon U.S.A. State and municipal loans. The Foreign Bond Market was inclined to dullness, and was practically featureless. In the Oil Market, Mexican Eagles was the one outstanding share, touching at one time 29s. The Rubber Market was again dull and listless, but Industrials continued active, with, of course, the Cable Group the outstanding feature of the week.

Home Rails.

Disappointing traffic returns have caused interest to sag in the Heavy Lines, but the Underground Group has been very much to the front on the persistently good traffics and improving outlook or the system generally. Underground ordinaries, in which a large business has taken place each day, have been on the rise all the week, and are now 25s., an advance of 1s. 7½d., with the 6 per cent. income stock 119, against 107 less than a fortnight ago. Districts have also been in active inquiry, and at 72½ are a couple of points to the good. Per contra Metropolitans were a bit on the dull side, and only just managed to maintain their small rise of the previous week. There was a very bullish feeling about anent Undergrounds, which, it is understood, have been recently bought in fairly large numbers on South African account, a result, it is imagined, of Mr. Solly Joel having a seat on the board.

Electricity Supply.

Extreme activity continues to be the order of the day in the Home Electric Market, but a certain amount of End-Account profit-taking occurred in the Home Counties Companies, and, as a consequence, prices, in most cases, receded a little from their previous high level. Bournemouth and Poole, after 77s., sagged off to 72s., on the non-appearance of the report. Metropolitans are a firm market at 47s., and, from the chairman's speech at the annual meeting, would not appear to be much over-valued at this figure. Electric Supply and Urban have both sagged a little, the latter losing 5s. at 51s. The feature during the last few days has been Isle of Thanet ordinary. Rumour has it that shareholders will shortly receive an offer of 40s., and as a result the shares were run up to 33s. 6d., from which they dropped to 27s., only to recover quickly to the present price of 33s. Considering the smallness of the share capital, an enormous amount of business has taken place during the last few days. The participating preference have also been active, and are now around 26s. 6d., after having been 32s. County have been extremely active, and are now 36s. 6d., on the excellent report to hand this morning. North Metropolitans, on a little selling pressure, relapsed at one time to 40s., at which figure they encountered buying orders, and quickly recovered to 43s. A newcomer was the 7 per cent. *cum* £1 preference of the Altrincham Electric Company, which is controlled by the Edison Swan Electric Co., and a good number of shares changed hands in the neighbourhood of 20s. 9d. London Power 5 per cent. debenture was in active demand, and rose to 1⅛ premium, and Folkestones at 44s. were in small inquiry on the dividend announcement.

Power Companies and Others.

Newcastles, although active, are unchanged, the excellent report not yet having had time to sink in. Net profits and units sold are the highest in the history of the company. There is no mention in the report of a new issue, but as the capital acocunt is some £900,000 over-spent and the board has powers to create new capital up to £1,000,000 a year without calling a meeting of shareholders, an issue is not unlikely before the year is out. Yorkshires were very active, the new partly paid being at one time 9s. bid, equal to 33s. for the fully paid shares. The old are 33s. 6d. x.d. North Wales were moderately active around 14s. 6d. A strong feature in Foreign Electrics was the Belgo-Canadian Group, which were in active inquiry. Barcelonas, International Holdings, and the new

Hydro-Electric Securities were all higher on the week, with Mexican Lights at 85, no less than 12¼ points to the good. The fixed charges of this group were, if anything, inclined to dullness. Perak River Hydro-Electric ordinaries were good around 14s. 6d., with the 7 per cent. consolidated debenture stock higher at 106½. Kalgoorlies marked once or twice, and are round 9s., and there was the usual bread and butter business in the securities of the Atlas Light & Power Co.

Cables.

The market at first glance is inclined to be favourable to the Cable-Wireless Scheme which made its appearance during the week. The main outlines are as follows: It is proposed to create a holding company to take over the undertakings of the Eastern Group of Cable Companies and the Marconi Wireless Telegraph Company by an exchange of shares. The allocation of shares in the new company is such that, on the basis of the profits of the combined undertakings for last year, the Cable Companies should be in a position to maintain their dividends on the present scale, and the proportion of profits available to the Marconi Company would equal approximately 35 per cent. on its present share capital, assuming that all the debenture stock is converted. Of any further profits 35 per cent. would go to the Eastern Companies and 65 per cent. to Marconi, and it is this lion's share of the equity which, in market opinion, gives such speculative possibilities to the 10s. ordinary shares of the Marconi Company. Some of the knowing ones evidently guessed that the announcement was imminent, as Marconis touched as high as 71s. prior to its publication. What they apparently did not know was that the provisional scheme was to be so favourable to the Eastern Group, which hardly moved until after the announcement was in the papers, when they made up for lost time and went ahead in no uncertain fashion. Eastern Extensions were up 4½ points at 19½, and Eastern Telegraph ordinary touched 200, a rise of no less than 60 in under 48 hours, with Westerns 5½ up at 19. Marconis themselves have been jumping all over the place, and have ended the account at 66s., having had to sustain a very considerable amount of profit-taking from people who had bought lower down earlier in the week. The convertible debentures have come more into line with the prices of the shares, and at one time touched 210, from which figure they reacted to the double century mark, which is equal to 60s. for the shares. Even now they are somewhat the cheaper purchase of the two. The preference shares have also been extremely active, and are now 5¼, a rise of 30s. on the week. From a percentage point of view, the greatest rise of all has been the Canadian Marconis, which, as a result of aggressive buying from Wall Street, touched 31s. 6d., a rise of no less than 100 per cent. in a week! There is no apparent reason for such a price, which is entirely due to manipulation from the other side, and Canadian Marconis now appear to be a share which can be very safely left alone! They have since reacted to 27s. 6d., after considerable fluctuations.

Tramways.

With so much excitement elsewhere, it was only to be expected that the Tramway Section would continue to be out of favour. The little spurt in the London and Suburban Traction and London United Tramway shares appeared to have petered out through lack of interest. Lancashire United Transport met with a little buying inquiry, which put them to 8s. 9d., a rise of about 1s., and both Potteries ordinary and preference were fairly active. Hastings Tramways were dull, the ordinary marking as low as 9d., with the preference 7s. British Electric Traction deferred was a good market, dealings taking place as high as 520. British Columbia Electric Railway issues were in evidence, and are higher, the deferred now being 215, at which price it yields under 3¾ per cent., tax free. Brazilian Traction common was very active, and at 216 gained nearly 10 points. The preference at 175 were also higher on the week. There has been a fair amount of investment inquiry for bonds of the operating companies of the Brazilian Traction Company, such as Sao Paulo Trams 5 per cent. at 95, and Rio de Janeiro Tramway, Light and Power 5 per cent., first and second bonds at 100 and 94, respectively. The Anglo-Argentine Tramway shares were all without interest. The City of Buenos Aires Tramways ordinary and debenture stock were both dealt in at 4¼ and 67, respectively. This company enjoys a rent charge of some £70,000 per annum, which is an absolute prior charge upon the revenues of the Anglo-Argentine Tramways Co., Ltd.

Manufacturing.

Uncertainty as to the future and competition from other and more active share markets has tended to give a dull tone to electrical equipment ordinary shares, and there is hardly a feature worth mentioning. Met-Vickers continued on the dull side, and General Electrics were at one time down to 34s. 6d., with Siemens following suit at 29s. British Aluminium ordinary were sold on disappointment of the non-appearance of an increased dividend, an exceedingly sound balance sheet position being ignored. The shares at one time dropped to 46s., but afterwards recovered a little, and are now 48s. There is very little doing in the cable makers' shares, which, however, all retained their price level, with the exception of Callenders, which are fractionally lower. Power Securities Corporation, both ordinary and preference, were harder at 27s. and 26s., respectively, and Aron Electricity Meter ordinary—a share which does not often come to market—was dealt in at 15s.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price Mar. 19. 1928.	Rise or fall.	Yield. p.c.
	£					
Bournemouth and Poole	1	14†	14†	72/-	—1/3	3 17 9
Brompton Ordinary	1	10	8¾	25/6	—	5 9 10
Charing Cross Ordinary	1	15	8½	26/6	—	5 5 8
do. do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	8⅞	26/-	—	5 7 8
City of London	1	15	10	32/6	+1/-	4 6 2
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	34/-	—	4 14 2
County of London	1	15	7½	36/6	—1/-	4 2 2
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundsons' Ordinary	1	8	10	67/6	—	2 19 2
do. 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	52/-	—9d.	4 4 7
Kensington Ordinary	1	15	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	10	8½	25/6xd	—	5 9 10
do. do. 6% Pref.	5	6	6	5½	—	5 8 2
Metropolitan	1	11	8	47/-	+1/-	3 18 3
do. 4½% Pref.	1	4½	4½	17/-	—	5 8 6
Midland Counties	1	6	6	26/6xd	—	4 18 1
Newcastle-on-Tyne Ordinary	1	7	5	26/6	—	4 10 7
do. 5% Pref.	1	5	5	18/9	+9d.	5 6 8
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	10⅝	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	5	17½	8	26/6xd	—	5 5 8
South London	1	15	8½	26/-	—	5 7 8
South Metropolitan Pref.	1	7	7	1⅛	—	6 3 0
Urban Ordinary	1	7	7	51/-	—5/-	2 14 10
do. 6% Pref.	1	6	6	1⅛	—	5 13 0
Westminster Ordinary	1	15	8½	26/-xd	—	5 7 8
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	22/-	—	6 16 4
Yorkshire Elec.	1	8	8	33/6	+1/6	4 15 7

HOME RAILS.

Central London Ord. Assented	Stock	4	4	74½	+½	5 7 5
Metropolitan	,,	5	3	67xd	—	4 9 7
do. District	,,	3½	3½	72½xd	+2	5 13 4
Underground Electric	£1	Nil	1½	25/-xd	+1/7½	4 0 0
do. do. Income	Bonds	6	6	119	+7	5 0 10

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	98½	+6	6 1 10
do Def.	,,	1½	1½	23	+½	6 10 5
Automatic Telephone	1	3	10	47/-	—	4 5 1
Chili Telephone	5	5	6	7⅞	—	3 18 3
Eastern Extension	10	10	10	19½	+4½	*5 2 7
Eastern Tel. Ord.	Stock	10	10	200	+60	*5 0 0
Globe Tel. and T. Ord.	10	10	10	20	+5	*5 0 0
do. do. Pref.	10	6	6	10½	—	5 17 1
Great Northern Tel.	10	20	20	38½	—	5 3 11
Indo-European	25	8½	10	35	—	*6 1 5
Marconi	10/-	Nil	5	66/-	+6/9	1 10 3
Marconi-Marine	1	7½	8½	43/6	+2/6	4 0 6
Oriental Telephone Ord.	1	12	12	51/3	—	*4 13 6
United R. Plate Tel.	5	8	8	10½	—⅛	*8 18 1
Western Telegraph	10	10	10	19	+5½	*5 5 3

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	3⅞	—	7 6 8
do. do. 2nd Pref.	5	6	6	3⅛	—	7 17 4
do. do. 5% Deb.	Stock	5	5	78½	—	6 7 5
British Electric Traction Def. Ord.	,,	—	—	515	—	... ...
do. do. 8% Pref. Ord.	,,	7	8	124½	—	6 8 6
Brazil Traction	100	5	6	216½	+9½	2 5 6
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	94½	+1	5 5 10
do. do. Preferred	,,	6½	6½	166½	+1	*3 15 1
do. do. Deferred	,,	8	8	215	+5	*3 14 5
do. do. Deb.	,,	4½	4½	89½	—	5 1 10
London & Sub. Trac. 5% Pref.	1	Nil	Nil	8/-	—	... ...
London United Tram Deb.	Stock	4	4	57½	—	6 19 2
Mexico Trams, 5% Bonds	—	5	5	80	—	6 7 5
Mexican Light Common	100	Nil	Nil	85	+12½	... ...
do. 7% Pref.	100	Nil	Nil	78	—	... ...
do. 1st Bonds	—	5	5	82½	+3	6 6 2
Yorkshire (West Riding)	1	5	—	7/6	—	... ...

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	13	13	69/-	—	3 15 4
British Aluminium Ord.	1	12½	10	48/-	- 2/-	*4 3 4
British Elec. Transformer Pref.	1	7	7	19/-	+9d.	7 7 4
British Insulated Ord.	1	15	15	4½	—	3 12 8
Brush Ord.	1	10	10	29/-	—	6 17 11
Callenders	1	15	15	4½	—⅛	3 12 8
do. 6½% Pref.	1	6½	6½	23/-	—	5 9 5
Crompton Parkinson Pref. Ord.	1	—	—	17/6	—	... ...
Edison-Swan	4/-	10	10	10/-	—	4 0 0
do. 6% Deb.	Stock	5	5	90	—	5 11 0
Electric Construction	1	10	7½	26/-	—	5 15 5
Enfield Cable Pref.	1	7½	7½	26/3	—	5 14 3
English Electric	1	Nil	Nil	7/6	—	... ...
do. do. Pref.	1	6	3	11/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	7½	7½	35/-	—	4 5 9
Henley	1	20	25	5½	—	4 10 11
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	Nil	12/6	—1/3	... ...
Johnson & Phillips	1	17½	12½	53/9	—	4 12 7
Met.-Vickers Ord.	1	8	8	32/-	—	3 15 0
do. Pref.	2	8	8	2⅜	—	6 1 11
Siemens Ord.	1	7	7½	29/-	—1/-	5 3 5
Telegraph Construction	12	10	10	23½xd	—	*5 1 0

* Dividends paid free of Income Tax.
† 4% of which was Tax Free.

Our Foreign Electrical Trade.

Electrical Exports and Imports during February, 1928.

IN examining the statistics of our electrical exports and imports during February, it has to be remembered that the month was a short one, although, this being Leap Year, it had an extra day. Thus, although the export total showed a decrease of £64,489 as compared with January, the actual daily average (including Sundays) was greater. This argument, of course, does not hold good in comparing the figures with those for February, 1927. Reverting to the comparison with January, it will be seen that the greatest decline was in the machinery section. Although there was a rise of nearly £20,000 in the exports of railway and tramway motors, in the class as a whole there was a net fall of almost £111,000. Submarine telegraph and telephone cable, in accordance with its usual practice, showed a large variation—in this case a fall of £35,461; batteries and accumulators also declined to a substantial extent. The principal increase was shown by telegraph and telephone instruments and apparatus, and another item in this section—non-submarine telegraph and telephone wires and cable—also rose by £21,781. Unenumerated electrical goods and apparatus were higher by £39,764. The decrease in the total from the February, 1927, level was in the neighbourhood of the fall as compared with January. Here, again, the machinery class was mainly responsible, showing a net decrease of £92,095. There was a serious fall (£67,694) in insulated wires and cables, but this was more than compensated for by a rise of £77,923 in the case of non-submarine telegraph and telephone wires and cable. Another large decline was exhibited by batteries and accumulators. Telegraph and telephone instruments and apparatus were higher by £65,494, and the net increase in this section was £127,145.

The total imports were below the average for 1927, and £92,230 below the January level. The decrease was general, there being only three increases of small dimensions. The most drastic reduction occurred in the case of glow lamps (from £80,698 to £45,991), while unenumerated goods and apparatus, and batteries and accumulators also recorded large declines. As compared with February, 1927, imports increased by about a third; there was actually only one decrease, that of £1,365 in arc lamps and parts. A very substantial rise was manifested by the machinery section, and it is noteworthy that it coincides with a serious fall in exports of this class. Other leading increases were:—Unenumerated goods and apparatus, £23,491; glow lamps, £21,430; and telegraph and telephone instruments and apparatus, £13,311.

The relatively unimportant re-export section showed a further decline in both comparisons.

So far this year exports have fallen by about the same amount as the imports have risen.

The following table shows the distribution of our exports of electrical machinery during February last, and compares the figures with those for the corresponding month of last year:—

Destination.	Feb., 1927.	Feb., 1928.	Inc. or dec.
	£	£	£
European countries	85,045	59,954	−25,091
Japan	27,979	37,557	+ 9,578
South America ...	34,609	83,447	+48,838
South Africa ...	131,530	37,370	−94,160
British India ...	94,348	91,731	− 2,617
Australia	91,148	40,632	−50,516
New Zealand ...	47,771	20,643	−27,128
Canada	14,866	11,909	− 2,957
Other countries ...	54,987	106,945	+51,958
Totals ...	£582,283	£490,188	−£92,095

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Feb., 1928.	Inc. or dec. as compared with Jan., 1928.	Inc. or dec. as compared with Feb., 1927.	Electrical imports for Feb., 1928.	Inc. or dec. as compared with Jan., 1928.	Inc. or dec. as compared with Feb., 1927.	Electrical re-exports for Feb., 1928.	Inc. or dec. as compared with Jan., 1928.	Inc. or dec. as compared with Feb., 1927.
Electrical goods and apparatus (unenumerated)	£202,170	+£39,764	− £8,480	£110,349	− £18,628	+ £23,491	£4,666	−£1,078	− £984
Insulated wires and cables ...	239,635	− 4,888	− 67,694	54,596	− 7,994	+ 2,173	700	− 1,084	+ 478
Glow lamps	36,984	− 6,043	− 1,929	45,991	− 34,707	+ 21,430	1,438	+ 375	− 653
Arc lamps and parts	1,534	+ 9	− 1,261	1,432	+ 840	− 1,365	201	+ 193	+ 145
Batteries and accumulators ...	72,207	− 15,535	− 28,859	38,035	− 10,514	+ 4,438	1,074	+ 759	+ 663
Meters and instruments ...	27,781	− 3,807	+ 1,687	22,194	− 4,977	+ 5,984	1,228	+ 342	+ 814
Carbons	1,600	− 1,252	+ 787	13,107	+ 2,214	+ 7,436	212	+ 161	+ 187
Switchboards (not telegraph or telephone)	13,207	+ 1,442	+ 5,556	66	+ 66	+ 57	—	—	—
Electrical Machinery—									
Electrical machinery (unenumerated)	262,276	− 70,773	+ 14,333	140,376	− 7,720	+ 42,491	7,873	− 682	− 79
Railway and tramway motors	61,960	+ 19,810	− 19,537	—	—	—	—	—	—
Other motors and generators...	165,952	− 59,959	− 86,891	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	122,950	+ 21,781	+ 77,923	6,195	− 5,639	+ 1,023	—	− 179	− 239
Submarine telegraph and telephone cable...	8,219	− 35,461	− 16,272	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	265,737	+ 50,393	+ 65,494	48,183	− 5,171	+ 13,311	3,382	− 621	− 1,973
Totals	£1,482,202	− £64,489	− £65,163	£480,524	− £92,230	+£120,469	£20,774	−£1,814	−£1,641
Increases and decreases for 1928		Exports. − 228,730			Imports. + 215,123			Re-Exports. + 2,193	

The Ideal Home Exhibition.

A Review of the Electrical Features.

(*Concluded from page 484*).

James Bourlet & Sons, Ltd.

Some of the most artistic and highly-finished electric light fittings in the Exhibition are to be seen at this stand of specialists in house decoration. There is no doubt that the artist in the psychology of colour has here had a free hand, regardless of the question of cost, mere black and white illustrations failing completely to give any idea of the novel designs of table and other lamps on view.

The British Hanovia Quartz Lamp Co., Ltd.

Included in the bathroom fitting display of Messrs. John B. Venning & Co., Ltd., are two examples of the ultra-violet ray lamps made by the British Hanovia Quartz Lamp Co., Ltd. The pattern known as the "Homesun" (fig. 7) is of the portable type, adapted to be connected up to any electric light wall socket. The mercury-vapour burner, which is contained in an adjustable bowl-shaped reflector, is designed to give, without regeneration, effective radiation for about 600 hours, corresponding to from two to three years of private use.

Restlight, Ltd.

The display of this firm is practically a duplicate of that at the British Industries Fair at the White City, reference to which was made in a recent issue. It includes the Lamplough Daylamp, which is designed to give a true reproduction of average "north light," and Restlight lamps.

The Delco-Light Co.

Several examples of the Delco-Light self-contained electric lighting plants are to be seen at this stand. A set new to this country is a non-battery type designed for use on fishing vessels, constructional work, &c. (fig. 6). It comprises a 2½ h.p.

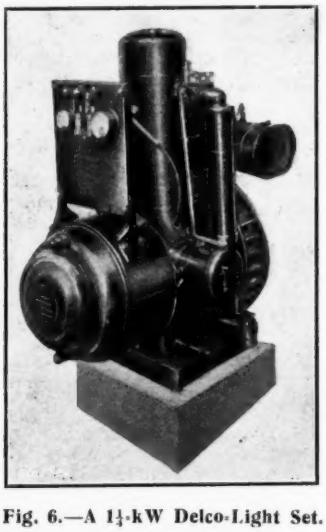


Fig. 6.—A 1¼-kW Delco-Light Set.

four-stroke engine of the air-cooled single-cylinder type, the flywheel being constructed so as to act as a fan in drawing a current of air through both the 1¼-kW, 110-volt generator and the casing surrounding the engine cylinder.

L. G. Hawkins & Co., Ltd.

On this stand prominence is given to the "Vio-Ray" sunlight outfit for home use, available also as a radiator. The familiar "Universal" appliances are shown in great variety, and include a new automatic safety iron with a thermostatic cut-out. The "De Luxe" vacuum cleaner and an electric floor polisher are shown, as well as electric light fittings, table lamps, &c.

Duncan Watson & Co.

Washing and ironing machines figure largely in this exhibit, including the "Rotarex" and "Apex" patterns, vacuum cleaners, floor polishers, drying cabinets and refrigerators; numerous improvements have been made in the "Rotarex" electric renovator.

S. G. Brown, Ltd.

This firm's exhibit is largely a duplicate of that at the recently-closed British Industries Fair at the White City, but while the latter was mainly prepared for the benefit of trade visitors, that at the Ideal Home Exhibition is laid out to instruct and interest the general public in the latest forms of the Brown wireless loud speakers, included in the range of which are two new models, the "Mascot" and the "Universal."

Hotpoint Electric Appliance Co., Ltd.

The display of this company includes the "Maytag Gyrafoam" washing machine and wringer, the well-known "Hotpoint" electric irons, and a wide range of electric water heaters. One of the latest productions is an instantaneous

Fig. 7.—The "Homesun" U.V. Lamp.

Fig. 8.—The Hotpoint Instantaneous Water Heater.

heater—a self-contained unit adapted to be connected up to the cold-water pipe in place of the ordinary cold tap; either cold or hot water can be obtained from it instantly by turning the tap either to the left or right. The heater, which has a loading of 6.5 kW, is provided with a regulator by means of which the temperature of the water can be controlled.

Revo Electric Co., Ltd.

This company, which exhibited at the British Industries Fair, here also has a display of its electric cookers, including the new breakfast cooker and automatic quick-boiling kettle, the "Revo" wash boiler, and other domestic appliances.

Electric Refrigerators.

The refrigerator is rapidly gaining in popularity as a household appliance, and a variety of patterns is on exhibition. The Electrolux Co., Ltd., shows its interesting device with no moving parts, which has been fully described in our pages. Frigidaire, Ltd., has a range of its apparatus on view, with motor-driven compressors. Kelvinator, Ltd., shows automatically-controlled refrigerators. Marco Refrigerators, Ltd., an old-established British firm, is showing for the first time a new automatic refrigerator with electrically-driven compressor. Another British-made machine is that of Freezore, Ltd., of the motor-driven compressor type with automatic control. The "Barnett" machine is shown by Easiwork, Ltd., as well as the "Croco" electric ventilator, which operates in either direction as desired.

Suction Cleaners.

Electric suction cleaners are shown on numerous stands. Electrolux, Ltd., has two stands, displaying its cleaner and floor polisher. The Tellus Super Vacuum Cleaner, Ltd., shows models with novel features. Messrs. Hoover, Ltd., show their cleaner with its "agitator"; the Electric Appliances Co., Ltd., has improved models on view, and the "Thor" cleaner is shown by the Hurley Machine Co., together with the washing and ironing machines of the same name. Messrs. Volta, Ltd., show cleaners of the semi-portable type, up to large sizes with a motor taking 620 watts. The British Vacuum Cleaner & Engineering Co., Ltd., is exhibiting its "Goblin" and "TurbineT" machines. The "Purcar" cleaner is shown by Messrs. Markt & Co. (London), Ltd., and the Sturtevant Engineering Co., Ltd., has on view a range of suction cleaners.

Miscellaneous Exhibits.

The Sheringham Daylight Co. shows its well-known reflectors in various forms. Electro-Rays, Ltd., exhibits examples of the "Uvral" ultra-violet and infra-red radiation apparatus, the "Astro" carbon arc lamp and the "Astro" reflectors. Messrs. H. J. Robinson & Son display several examples of the "Windsor" electric ovens and hot plates and also the "Milliwatt" electrically-heated cushion. The "Beatty" electric washer is shown by Messrs. Beatty Bros., Ltd., and the Rawlplug Co., Ltd., demonstrates the strength of its well-known fixings.

Modern Sub-Station Equipment.

The Horseferry Road sub-station of the Westminster Electric Supply Corporation contains what are claimed to be the largest rotary-convertor sets yet installed in this country.

THE new equipment at the Horseferry Road power station of the Westminster Electric Supply Corporation, which has been converted to sub-station service, is of considerable interest in that it includes rotary-convertor sets of larger capacity than any previously used in this country. Four sets are installed, each of 3,000-kW capacity; two of these have been supplied by the Metropolitan-Vickers Electrical Co., Ltd., and two by the British Thomson-Houston Co., Ltd., all having been made to the specification of Mr. P. L. Riviere, M.I.E.E., engineer-in-chief to the Corporation. The equipment also includes a notable installation of metal-clad h.p. switchgear and metering equipment supplied by the M.V. company.

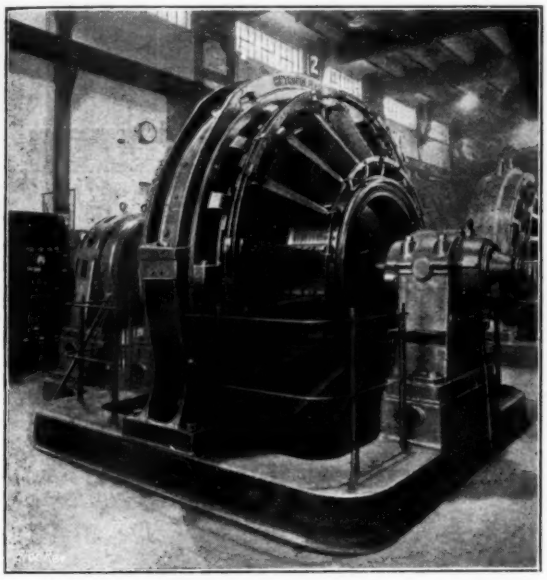


Fig. 1.—3,000-kW M.V. Rotary-Convertor Set.

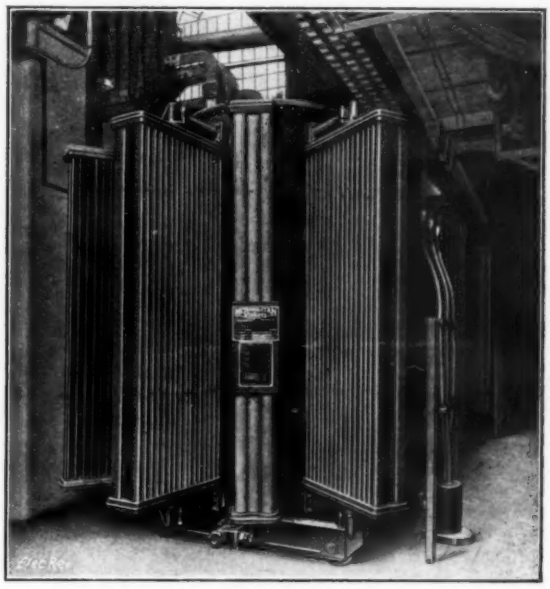


Fig. 2.—3,300-kVA Transformer.

The h.p. supply to the sub-station is taken from the 22,000-V distribution system of the London Power Company, four h.p. feeders being connected, two from the Pelham Street and two from the Amberley Road sub-stations. The rotary convertors operate in parallel and supply at 440 volts for general service to the district. Fig. 1 shows one of the M.V. convertors and its starting panel on the left. The machines are of the makers' shunt-wound 3-wire standard type, and are arranged for motor-starting and self-synchronising. They run at 333 r.p.m., have 18 poles, and give a range of d.c. voltage of from 400 to 460. They are also capable, it is claimed, of giving their full output at the mean d.c. pressure of 430 V, in accordance with B.E.S.A. specification No. 172; the other requirements of this specification are also met. Each set is over 16 ft. in overall length, 12 ft. in width, and 11 ft. in height above floor level, and weighs 38 tons.

With regard to the construction of the machines, end shields are fitted extending over the windings to reduce windage and noise. Hinged sheet-steel guards on the d.c. brushgear protect the brush flexibles and springs in the event of heavy short-circuits producing flashing on the commutator. Suitable barring gear is also provided.

The starting motors have solid cast-steel "indestructible" rotors. It is of interest to note that the initial starting torque of each motor is equivalent to the torque of a motor developing 450 h.p. at full speed. In order to deal with the heavy starting currents the starting panels are equipped with contactors connected in series with the motor, and arranged to open before and close after the usual 3-pole change-over switch.

Fig. 2 shows one of the 3,300-kVA transformers for supplying the convertors. These give a 6-phase supply at 324 V to the rotaries, tappings of ± 2½ and 5 per cent. being provided on the h.p. windings and a mid-point l.p. tapping for 3-wire operation. The construction is of the core-type, with spiral l.p. and disk-wound h.p. windings, the latter being equipped with the M.V. patent spring dash-pots for maintaining the coils tightly clamped. Both windings are of paper-covered wire, and the units are immersed in oil tanks of boiler-iron with detachable radiators. Single-pole sealing bells are provided for the h.p. cables, while the l.p. connections to the rotaries are of interleaved copper strap. Cambridge index thermometers show the oil temperatures in each tank.

The h.p. switchgear is an excellent example of modern practice with metal-clad compound-filled gear. Ten M.V. type K. circuit breakers, fig. 3, are installed, each having a breaking capacity of 500,000 kVA. Four units control the duplicate 22,000-volt feeders, four govern the supply to the machines, and two serve for busbar coupling and sectionalising. The

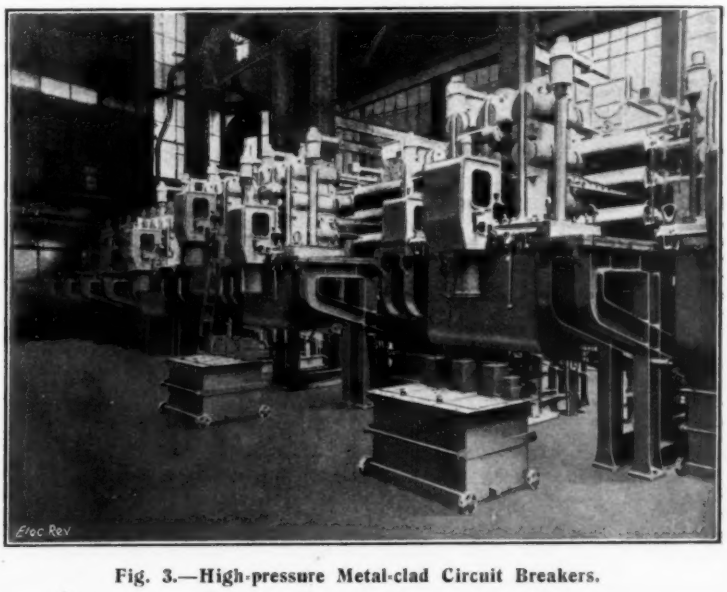


Fig. 3.—High-pressure Metal-clad Circuit Breakers.

circuit breakers are remotely controlled from a ten-panel enamelled-slate control board, fig. 4, which is equipped with a mimic diagram showing the positions of all the circuit breakers and isolating devices. A complete system of protective relays is so arranged that the automatic tripping of any switch causes the operation of a warning Klaxon horn and at the same time lights a green indicating lamp on the particular panel affected. A white lamp on each control panel is connected to indicate the working condition of the trip circuit of the circuit breaker.

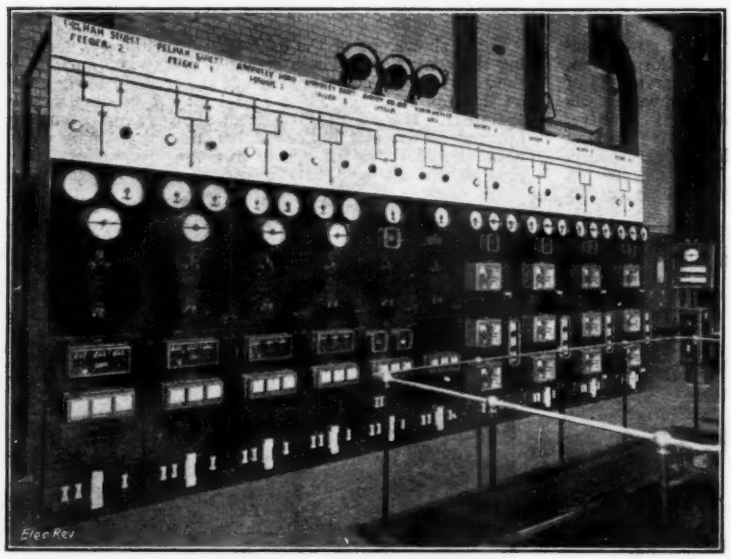


Fig. 4.—The Control Board.

The supply to each rotary-convertor set is registered by three Thomas averaging recorders. The potential and current transformers for this equipment are installed in a basement below the switch units, and the recorders are mounted on the rotary-convertor panels of the control board.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Private Bills.

The Weald Electricity Supply Bill and the Greenock and Port Glasgow Tramways Co. Bill have been read a second time in the House of Lords.

Television.

On March 13th, Sir W. Mitchell-Thomson, the Postmaster-General, informed Sir H. Brittain that wireless licences covering experiments in television had been issued to a number of persons. He understood that tests had been carried out, but his technical advisers considered that the matter had not yet advanced beyond the experimental stage.

G.P.O. Profits.

On March 13th, Sir H. Brittain asked what was the profit made during the past year by the telephone and telegraph section of the General Post Office; and how that compared with the profit of five years ago.

Sir W. Mitchell-Thomson said he was not quite clear what was meant by profit, but, on the assumption that it meant the surplus which in a commercial company would be available for payment of interest charges after providing for maintenance, depreciation, and operating costs, the figures for the combined telephone and telegraph services were as follows: 1921-22: Deficit, £1,573,115; 1926-27: Surplus, £2,968,921. In the interval a sum estimated at £3,000,000 had been returned to telephone subscribers in the form of reduced charges.

Underground Telephone Cables.

On March 13th, Sir W. Mitchell-Thomson informed Mr. Kelly that the value and single-wire length of the main trunk telephone cables laid underground in the year 1927 were respectively £349,000 and 41,000 miles. The corresponding figures for 1921 were £1,347,000 and 154,500 miles.

Oil from Coal.

On March 13th, Mr. D. Grenfell asked the Secretary for Mines whether he could inform the House how much progress was being made in extracting oil from coal; and whether he could say how much was being done to encourage experiments in low-temperature carbonisation and other methods?

Commodore King said that there were now five plants, each designed for a throughput of 100 tons a day or more, in working order in this country, representing at least five different processes for the low temperature carbonisation of coal. There were some six or eight further systems represented by plants with a capacity of 10 tons a day or over. Those included the type developed at H.M. Fuel Research Station, of which a 100-ton-a-day plant was being erected by the Gas Light and Coke Company. Large commercial plants of several of the other systems were stated to be under erection. The results obtained from those plants during the next few years should show how far, and under what conditions, each type was likely to be a commercial success.

Greater London and Counties Trust.

On March 13th, Mr. Looker asked the Minister of Transport whether he was aware that the Greater London and Counties Trust, Ltd., incorporated to supply electricity to the South of England, was raising, or proposed to raise, a large portion of its capital in America; and could he state what steps he proposed to take to ensure that the requirements of the companies involved for electrical plant and equipment were placed in the country.

Colonel Ashley said he had seen statements in the Press to the effect of the first part of the question. As regarded the second part, his approval was not required to the placing of orders for electrical plant and equipment by any electrical undertaking.

Mr. Looker asked whether it was consistent with the policy of the Ministry of Transport that the electrification of England should be carried out by American or other foreign capital rather than by British capital; and if the Minister considered that he had any obligation to ensure that orders for plant were placed in the United Kingdom rather than in foreign countries.

The Speaker said that that was almost the same as the previous question.

Mr. Hannon asked whether the Minister had not had a definite assurance from the Trust that it was prepared to purchase British machinery for all its requirements.

Col. Ashley said he had received a communication to that effect.

Electricity Companies' Capital.

On March 13th, Mr. Hardie asked the Minister of Transport whether, in view of the "watering" of capital in private enterprise electricity supply preventing the cheapening of energy, as promised by the Government when producing the last Act controlling the industry, he was taking any action to prevent this practice.

Colonel Ashley said he was not clear what particular circumstances Mr. Hardie had in mind, but perhaps he would furnish him (the Minister) with more specific details.

Empire Communications.

On March 13th, Commander Bellairs asked the Prime Minister if he would state when it was anticipated that the Empire conference on cable and wireless communications would make its report.

Mr. Baldwin said it was not possible to forecast a date when the Imperial Wireless and Cable Conference would render its report. He understood that the Conference was making every effort to do so as soon as possible.

Prices of Electricity.

On March 15th, Mr. W. Baker asked the Minister of Transport whether he was aware of the complaint regarding the prices charged by electricity companies; and whether, seeing that the Midland Corporation for Electric Power Distribution proposed to maintain its dividend of 15 per cent. and to distribute a bonus to its ordinary shareholders of one new share for every share held, he would consider the advisability of seeking statutory powers to restrict the prices charged.

Colonel Ashley said he was aware that complaints were sometimes made regarding the prices charged by electricity undertakers. As regarded the last part of the question, he already possessed statutory powers to revise periodically, on the application of local authorities, or a prescribed number of consumers, the prices charged by such undertakers.

The Cable-Wireless Merger and the Post Office.

Last week Lieut.-Commander Kenworthy gave notice of his intention to ask the Postmaster-General whether it was proposed to hand over any Government property or rights to the new cable and wireless telegraphy combine which had been, or was about to be, formed.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Swimming-bath Suction Cleaner.

The "Candy" suction sweeper, fig. 1, has been produced by the BASTIAN METER CO., LTD., 58, Haymarket, S.W.1, for removing the dirt and slime which is often found at the bottom of swimming baths. The motor, 1 h.p., is directly coupled to a pump, both being mounted on a suitable trolley. The sweeper, which is connected to the pump by a 2-in. suction

Fig. 1.—Swimming-bath Cleaner, Pump Unit.

hose, consists of a cast-iron box, 2 ft. wide, mounted on four rubber-tired wheels and fitted with squeegees. As the sweeper is moved backward and forward the box is automatically tilted, causing the front squeegee to be raised and the back one lowered, or *vice versa*. The sweeper is operated by either a long wooden handle or towing ropes. Each length of hose, normally 20 ft., is supported in the water by a float. The dirty water is run to waste. From 30 to 50 gallons of water are expended per min., in which time from 200 to 250 sq. ft. of the surface can be swept. Suitable motors and starting arrangements are furnished for all supply systems. Normally 100 ft. of c.t.s. flexible cable is provided. The gross weight of the equipment is 7 cwt.

A New Electric Cooker.

A recent development of Messrs. BELLING & Co., Bridge Works, Southbury Road, Enfield, is a small electric cooker (No. 2), fig. 2, which is, it is claimed, capable of all opera-

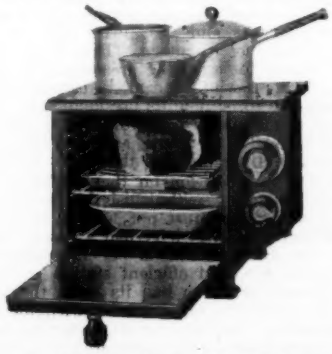


Fig. 2.—Electric Cooker for 2-4 Persons.

tions to meet the requirements of a family of from two to four persons. It is made entirely of cast-iron, with the hob and the door finished in vitreous enamel. The overall dimensions are 18.5 in. wide, by 14.25 in. high, by 13.5 in. deep, the respective oven cooking-space measurements being 12 in., 10 in., and 10.5 in.; the hob is 18 in. wide by 12 in. deep. The weight of the cooker is 70 lb., and it can be used as a table device, or a cast-iron stand for floor use can be supplied. There are two heating units, a plug-in one at the top, which will serve either as an enclosed boiling plate or for grilling or heating the oven, and one at the bottom which is used solely for heating the oven; the latter is completely enclosed. Both top and bottom elements are provided with three-heat control, and the maximum loading is 2.75 kW. The apparatus is also equipped with a removable grill pan and grid, rod and perforated shelves, and a baffle plate.

A New Earth Clip.

We have received from Messrs. E. G. MOORE & Co., 16, Harrington Street, Liverpool, representatives of the Earth Clip Co., a sample of the latest production of the latter firm, the "Tecol" earth clip. It is intended for use with conduit, and is claimed to eliminate the usual troubles resulting from vibration. It is made of copper and will, it is stated, expand and contract with the conduit. There is a recess or cavity in the "wing" of the clip, round the screw, in which the earth wire reposes, and from which, it is claimed, it is practically impossible for it to slip or get out of place.

A Plug and Socket Gauge.

A useful device, fig. 3, has been patented by Mr. C. W. DENNY, 75, West Cromwell Road, S.W.5, for indicating the necessary particulars as to the size, make, and so on, of wall plugs or sockets. The use of the gauge is self-explanatory from the illustration. It can be made up in various materials,

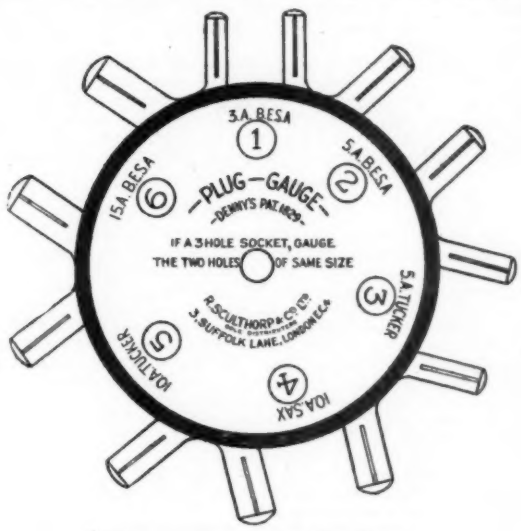


Fig. 3.—Plug and Socket Gauge.

such as red fibre and mill board, for use as an advertising novelty, or in bakelite for more permanent use as a tool for wiremen or salesmen. As indicated the distributors for the device are Messrs. R. Sculthorp & Co., Ltd.

A New Hand Lamp.

We have received from Messrs. A. H. HUNT, LTD., H.A.H. Works, Tunstall Road, Croydon, a sample of the latest addition to their range of "Sunlite" hand lamps, the "Sunlite Minor." This has the usual box-case construction, and is equipped with two cylindrical cells. A switch is conveniently placed at the top of the case for operation by the hand carrying the lamp. The external appearance is pleasing.

A Split-Phase Motor.

Messrs. WAGNER ELECTRIC SUPPLIES, LTD., 66, Victoria Street, S.W.1, have recently introduced a small split-phase motor suitable for driving such apparatus as washing machines and small pumps and lathes. It is claimed that, by means of a simplified split-phase quick-break switch the usual troubles of arcing, pitting, rusting, and so on, have been completely overcome. Further, it is stated that the switch will withstand 500,000 starts and stops without sign of breakdown. Other claims for this motor are high starting torque and overload capacity, low temperature rise, and silent operation. The motor is of drip-proof construction, with a steel body and feet, and is equipped with wool-yarn lubrication. The terminals are fully protected, and the motor is available in ⅛-, ¼-, and ½-h.p. sizes.

The Electrical Development Association.

Annual Meeting, Report, and Dinner.

Report for 1927.

THE report records a net increase of 23 in the number of supply undertaking members, 25 joining, and Glasgow Corporation and the Folkestone Co. resigning. An increased rate of subscription was adopted by 17 undertakings. Consideration is being given to the question of establishing the area committees (most of which were formed for campaign purposes) on a permanent basis, and widening the scope of their activities. An Industrial Heating Sub-Committee has been formed to study directions in which electricity can be employed in industry and to promote exhibitions and carry out educational propaganda. Exhibitions have been held at Poplar and at the Ferrybridge station of the Yorkshire Electric Power Co. The Rural and Agricultural Electrification Sub-Committee has been reconstituted and enlarged, and at the request of the Electricity Commissioners a report on methods of propaganda and education in rural districts is being prepared. The I.M.E.A. Refrigeration Sub-Committee has been transferred to the Association, and a special publicity campaign is foreshadowed. The Exhibition Advisory Committee is investigating the possibility of organising an electric village at next year's Ideal Home Exhibition. Other subjects touched upon are:—The E.D.A. Conferences; 136 lectures delivered by Mr. G. S. Francis to an aggregate of 13,000 people; the loan and exhibition of kinema films; the sale of literature (1,728 orders valued at £5,354); the production of 95 new publications; the Association's exhibit at the Royal Agricultural Show, Newport (Mon.); participation in local exhibitions; the Electrical Association for Women; the 1926-27 campaign and the current one; the death of Mr. W. M. Rogerson; and the departure of Mr. J. W. Beauchamp and the appointment of Lt.-Col. W. A. Vignoles, D.S.O., as director and secretary.

The membership now comprises:—299 supply undertakings (including 161 municipal and six Colonial); and 1,587 manufacturers, contractors, and wholesalers. The increase in membership was 149. The revenue was provided as to 55.4 per cent. by supply undertakings, 42.5 per cent. by manufacturers, 1.8 per cent. by contractors, and 0.3 per cent. by wholesalers.

The Annual Meeting.

The annual general meeting was held on March 16th, at the Savoy Hotel, London. Sir James Devonshire occupied the chair, and, in presenting the accounts, pointed out that the expenditure had been greater than the income. Lt.-Col. W. A. Vignoles, D.S.O. (director and secretary), said that although the income had slightly increased, it fell short by £3,000 of expectation. Mr. C. W. Sully (E.I.M.A.) said that the accounts did not clearly show the actual amounts spent on the campaigns. Lt.-Col. Vignoles said that a difficulty arose from the fact that the campaign periods did not coincide with the financial years. The accounts were adopted, on the proposition of Mr. D. N. Dunlop, seconded by Mr. R. P. Sloan, C.B.E., and Sir James Devonshire then dealt with the report which is abstracted above. He stated that if all the supply undertakings subscribed according to the full scale the Association's revenue would be doubled.

Mr. L. B. Atkinson (C.M.A.) considered that the report was very satisfactory; the Association was doing very well with the little money that it received. The electrical industry was certainly not providing funds according to its ability. The report was adopted. Mr. Atkinson then proposed that the Association should accord its thanks to Mr. J. W. Beauchamp for the remarkable work which he had done as director and secretary. In seconding this Mr. R. P. Sloan said that Mr. Beauchamp had put in an enormous amount of time and effort on behalf of the Association. The vote was carried with acclamation. Lt.-Col. Vignoles regretted that he had heard from Mr. Beauchamp that he would be unable to attend the dinner that evening, although he had intended to do so.

Mr. W. C. P. Tapper proposed the election to the Council of the members nominated, and this was carried. The new members were Messrs. P. F. Crinks and E. G. Batt (B.E.A.M.A.), Mr. S. G. Leach (E.W.F.), Mr. H. T. Young (I.E.E.), Mr. F. Leete (C.M.A.), Mr. W. A. Shaw (E.C.A.), Messrs. J. W. Beauchamp and P. D. Tuckett (Inc. Association of Electric Power Companies), Mr. F. Bailey (Conference of Chief Officials of L.E.S. Companies), Mr. W. F. Moir (E.I.M.A.), and Messrs. F. W. Purse and H. C. Lamb (I.M.E.A.).

Introducing the new President (Mr. J. M. Gatti), Sir James Devonshire said that he and his family were pioneers of electricity supply in London, and Mr. Gatti had served with distinction as chairman of the London County Council. Mr. R. P. Sloan seconded Mr. Gatti's election as president, and, taking the chair, Mr. Gatti briefly expressed his thanks. Mr. A. C. Cramb was elected chairman, a position which he has held since Lt.-Col. Vignoles's appointment as director and secretary. The meeting concluded with votes of thanks.

The Annual Dinner.

In the evening the annual dinner took place at the Savoy Hotel. Mr. J. M. Gatti occupied the chair, and the guests included many leaders in all branches of the electrical industry. The first toast after the loyal toast was "The Greater Use of Electricity." In proposing it, Mr. Archibald Page (president, I.E.E.) said that the average person required to be stirred up before he would lift himself out of the rut, and therefore no commodity could successfully be left to sell itself. It had to be remembered that although electricity was the ideal agent for providing light, heat and power, it was not the only agent. To ensure the greater use of electricity it must be generated, distributed, and sold in the most efficient manner possible. Only by increasing consumption could the price be lowered. After a great deal of discussion a constructive policy of generation and distribution had emerged; the Central Board could be trusted to see that the supply would be adequate and regular. The steam age had increased the wealth of the world, but it had many undesirable consequences; electricity could restore much of the graciousness of life as well as increase efficiency. Many power station engineers would now be able to concentrate on distribution, and capital formerly spent on generating plant could be better devoted to showrooms, assisted wiring and propaganda. Mr. Page referred to the good work accomplished by Mr. Beauchamp, Mr. V. W. Dale, and their staff, and welcomed Lt.-Col. Vignoles, the new director and secretary. In conclusion, he said that electricity suppliers could help by simplifying and reducing their tariffs; manufacturers by reducing the cost of apparatus; and contractors by reducing installation costs.

Mr. Gatti, responding, said that the greater use of electricity had been the aim and object of his whole working life. He reviewed the difficulties with which the industry had had to contend, and said that obstacles had been placed in the way of the combination which was now the accepted policy In spite of all that had been said in the Press, electricity was a cheap commodity; it would not have reached its present position if it had not been. The average cost per unit had fallen from 1.77d. in 1914 to 1.62d. in 1926. Very few industries could say that their products were now cheaper than before the war. Many misleading comparisons had been made between the prices of electricity in London and in other leading cities of the world. Thus they had been told that New York had rates of 3½d. for lighting and ½d. for power. Upon inquiry he had found that 3½d. per unit (7 cents) was the charge under a combined lighting and power tariff. The power rate of 2 cents (which was presumably the ½d. referred to) was found to be the last stage of a sliding scale; the first 75,000 units cost 5 cents each. After consuming 1,100,000 units, one obtained the rest at 2 cents. He found that the average rate for a million units was 1.44d.; the London supply companies had never come across such good customers.

Mr. Ll. B. Atkinson, proposing the health of "The Guests," said that the presence of ladies at the banquet was significant of the fact that the men were at last realising that the future of electricity depended upon the renaissance of women. He also said that although many of the company lived in a state of mutual antagonism, at the dinner all their differences were sunk, and such questions as, for instance, the relative positions of the Commissioners and the Board and the purchase of foreign plant were not discussed. They were there with the common purpose of fostering the greater use of electricity. He welcomed Mr. Gatti, who, he said, had honoured the Association by consenting to become its president, and referred to the good work of Sir James Devonshire, to the youthfulness of Col. Crompton and Dr. Ferranti, and to other notable guests.

Mr. Frank Hodges replied to the toast, saying that, ironically, in view of his position on the Central Board, he had recently been struggling with legislation to improve the gas industry. However, he must not let fall at such a function one word to hint that electricity had a rival. The Board had found it a most difficult task to persuade a supply engineer that his was not the most efficient station in the world. He considered that all criticism had its uses; the attitude of the Press towards electricity was an acknowledgment of its existence. No industry could prosper if its charges were too high, and the electrical industry had prospered. The lower the price was reduced the greater would be the industry's profits and the national advantage. He was not perturbed by thoughts of an inrush of American capital into the industry, or that orders for plant would go to the United States. We had nothing to fear with regard to technique, design and development in the electrical industry. He accepted the idea that if foreign goods were cheaper and as good they should be purchased—always provided that conditions in the producing countries were on a par with conditions in this country.

Central England Electricity Scheme, 1928.

Prepared by the Electricity Commissioners in pursuance of Section 4 of the Electricity (Supply) Act, 1926.

A FURTHER step towards the full development of the Electricity (Supply) Act, 1926, has been made this week by the publication by the Central Electricity Board of the Central England Electricity Scheme, 1928. It deals with an area of 7,311 square miles, with a population, according to the last census, of roundly 5,218,146 persons. As will be seen from the accompanying map, the area embraces part of the counties of Bedford, Buckingham, Chester, Derby, Gloucester, Nottingham, Oxford, Shropshire, and the whole of the counties of Leicester, Northampton, Stafford, Warwick, and Worcester. Extending as it does from Stoke-on-Trent and Mansfield in the north to Buckingham and Tewkesbury in the south, and from Newark and Higham Ferrars in the East to Shrewsbury and the Welsh border on the west, it will be gathered that the area includes a very important industrial district, in which the mining, iron and steel, engineering, rubber, leather and textile industries are highly developed and form large users of power. In addition to the industrial districts the scheme provides for the extension of electricity supplies in the agricultural parts of the area in which they are, except in a few isolated instances, not at present available.

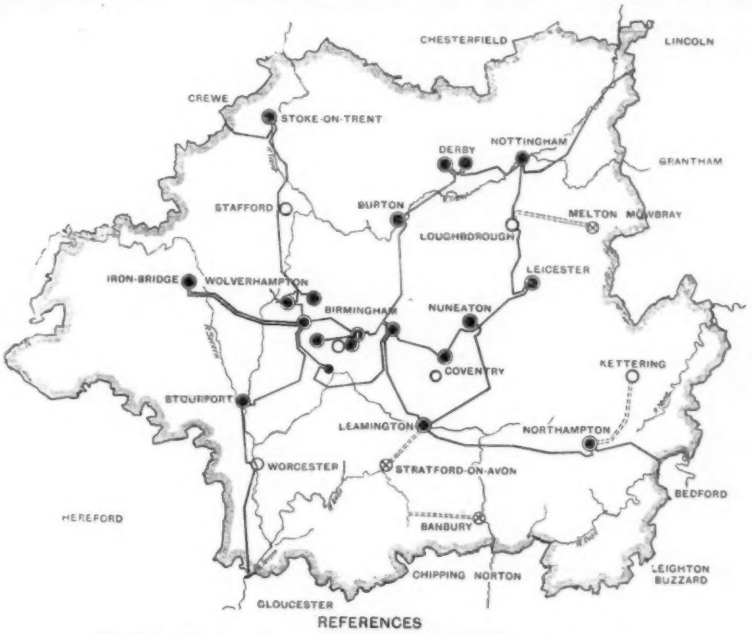
The latest ascertained figures for the undertakings in the area show that in 1926-27 the number of units sold was 762 millions, corresponding to 146 units per head of the population. The average rate of increase in consumption from 1921-22 to 1926-27 was 91 million units per annum, but in view of the known demands for large blocks of power supply, it is felt that this rate of increase must be considerably exceeded during the next two or three years. Indeed, after many inquiries, it is estimated that by 1934-35 the annual sales in the Central England area will amount to 1,890 million units, equal to 362 units per head of population, on the basis of the 1921 census, while for the six suceeding years, that is, up to 1940-41, the Commissioners have felt themselves justified in estimating for a greater and gradually increasing growth of output up to not less than 2,820 million units, equal to 540 units per head of the 1921 population, and about 3¼ times the 1926-27 consumption. Moreover, this is apart from any growth in the demand for power for railway traction purposes that may arise, and which it is considered can be met by the principal generating stations and primary sub-stations that will be available.

At present there are 49 authorised undertakers in the area, falling mainly in three Electricity Districts, *viz.*, the West Midlands, the South-West and East Midlands, and the North-West Midlands, for which a Joint Electricity Authority is contemplated, and owning between them 46 generating stations. Of these only the following 19 are to be retained on the selected list and worked for the Board: Those of the Birmingham Corporation, known as Hams Hall, Nechells and Nechells (Princes); North Wilford (Nottingham Corporation); Stourport and Smethwick (Shropshire, Worcestershire and Staffordshire Electric Power Co.); Longford (Coventry Corporation); Spondon (Derbyshire and Notts Electric Power Co.); Freeman's Meadow (Leicester Corporation); Hardingstone (Northampton Electric Light and Power Co.); Avon and Hinckley (Leicestershire and Warwickshire Electric Power Co.); Burton (Burton-on-Trent Corporation); Derby (Derby Corporation); Stoke Central (Stoke-on-Trent Corporation); Ocker Hill, Walsall and Wolverhampton (West Midlands Joint Electricity Authority); and a new station of an initial capacity of 50,000 kW to be erected on the River Severn at Ironbridge by the West Midlands Authority. The scheme also provides for the working under temporary arrangements with the owners of the following six stations:—Hylton Road (Worcester Corporation), Kettering (Kettering Urban District Council), Loughborough (Loughborough Corporation), Sandy Lane (Coventry Corporation), Stafford (Stafford Corporation), and Summer Lane (Birmingham Corporation). The remaining 21 stations are to be gradually closed down or converted to transformer stations.

The extension of the following six stations is contemplated: (1) Hams Hall, an addition of 30,000 kW for operation by the winter of 1933-34, and a gradual further addition of 150,000 kW to be completed before the winter of 1940-41; (2) Hardingstone, an addition of 12,500 kW by the winter of 1934-35; (3) North Wilford, an addition of 50,000 kW by 1935-36, and a further 50,000 kW by 1940-41; (4) Spondon, an addition of 50,000 kW by 1937-38; (5) Stourport, an addition of 20,000 kW by 1934-35, and a further 100,000 kW by 1938-39; and Ironbridge, the first 50,000 kW of which is to be ready for operation by the winter of 1931-32, an addition of 50,000 kW by 1934-35, and a further 100,000 kW by 1940-41. All the extensions are to be of three-phase, 50-cycle plant.

Of the nineteen selected stations it is proposed that the base load of the area, which is estimated at about 40 per cent. of the total output, shall be entrusted to the new station at Ironbridge, the North Wilford at Nottingham, the Stourport, and the Hams Hall, three of them being thus located either on the River Severn or the Trent, and favourably situated, both for water and fuel supplies. It is also considered that a considerable amount of waste heat from coke ovens at present not utilised will be available for steam-generation purposes.

The Commissioners report that in drawing up the scheme a number of special matters had to be considered, owing to the various developments in the area which are already being effected, and to the fact that transmission lines of a secondary character have been established and are being extended, and that partial measures of electrical interconnection have already been, and are in process of being, carried out. The contemplated programme of construction of 132,000-V overhead primary transmission lines extends to 424 circuit and 369 road miles, and comprises the following: (1) Hams Hall to Nechells, Ocker Hill, Wolverhampton, Warwick, Bournville (part) and Coventry; from Ocker Hill to Stourport and Bournville; from Derby to Spondon and Nottingham; and from Northampton to Bedford (part), to be completed by 1929-30; (2) Hams Hall to Burton-on-Trent and Derby; from Nottingham to Loughborough, Leicester and Coventry; from Wolverhampton to Stafford, Stoke and Crewe (part); from Bournville to Hams Hall (completion); from Warwick to Northampton; and from Stourport to Worcester and Gloucester (partly to be completed by 1930-31); (3) from Ocker Hill to Ironbridge, and from Nottingham to Lincoln (part by 1931-32). Ring mains have been regarded as an essential feature in the design of the system in order to afford alternative routes to points of supply in all cases except one, this being the Ironbridge-Ocker Hill line, where a spur line is to be duplicated. It will be noted that the accompanying map shows terminating points for the main transmission lines—each of which is to be capable of transmitting not less than 50,000 kW—in approximately the four corners of the area, this provision having been made in order that eventually they may be joined up with the main distribution lines of surrounding areas so as to form one comprehensive system for the whole country.



Central England Electricity Area, showing Generating Stations, Sub-stations, and Transmission Lines.

In connection with the lines, ten transformer stations are to be established in connection with group 1, eight for group 2, and one for group 3. The nineteen high-pressure transforming stations and their installed total capacity will be as follows:—

	kVA.		kVA.
Hams Hall	60,000	Warwick	60,000
Nottingham ...	60,000	Stoke	20,000
Leicester	40,000	Worcester	20,000
Ironbridge	225,000	Wolverhampton ...	90,000
Derby	20,000	Stafford	10,000
Stourport	150,000	Ocker Hill	150,000
Spondon	60,000	Loughborough ...	10,000
Nechells	90,000	Bournville	90,000
Burton-on-Trent ...	20,000		
Northampton ...	20,000	Total ...	1,235,000
Coventry	40,000		

The estimated cost of the primary lines and 19 transformer stations, together with the extension of one sub-station in 1935-36, including capitalised interest, is £3,597,679.

On the secondary, 33,000-V. side, no extensions will be completed before 1930-31, when £48,600 is to be expended on overhead lines and cables, and £32,670 on two new sub-stations in group 2, and £114,390 on lines and cables, and £54,230 on five sub-stations in group 3. The total installed capacity of the lower voltage transforming stations will be 38,000 kVA, divided as follows: Northampton and Kettering, 15,000 kVA each, and Loughborough, Melton Mowbray, Stratford-on-Avon, and Banbury, 2 000 kVA each.

One of the difficulties to be solved was that of dealing with the existing 25-cycle generating plant which is to be taken over. After long negotiation it has been agreed that no further 25-cycle plant beyond that already sanctioned shall be installed; that any development of 25-cycle supplies shall be limited to the safe output from the Nechells, Summer Lane, and Smethwick stations; that all other parts of the systems of the Shropshire, Worcestershire, and Staffordshire Electric Power Co., and of the Birmingham Corporation, including the Hams Hall and Stourport stations, shall be gradually changed over in convenient sections from 25 to the standard 50 cycles per second frequency; and that in the case of the heavily-loaded centres supplied for the time being at 25 cycles, the change-over shall be made in a manner that will avoid any dislocation of the industrial systems. Certain other undertakers will be also required to change over from 25- to 50-cycle frequency. The estimated cost of the total change-over in frequency, continued without interruption from the present year, is estimated at £2,061,400, which, on a 5 per cent. interest basis and a 40-year sinking fund, represents an addition to the annual capital charges of £129,000. As against this the advantages of a standardisation of the frequency in the way of a reduction of the number of patterns of motors, with consequent reduced cost of production, and in other directions of service to consumers are to be set.

The scheme will involve the Central Board in a capital expenditure, including capitalised interest, of £2,635,725 up to the end of 1930-31, and £3,597,679 to the end of 1934-35, at which time the total annual operating costs are estimated at £171,100, and the capital charges on transmission at £321,982. This is, however, only a part of the capital expenditure which will be involved in the scheme at the end of 1934-35, as there has to be added £2,061,400 as the estimated cost of frequency standardisation, and £1,975,000 for the new Ironbridge station and the extension of other plants, the aggregate thus being £7,634,079. Put another way, a table is given in the supplementary particulars which shows that the expenditure during the five years commencing with 1930-31—which is regarded as the most difficult period—under the Commissioners' scheme, as compared with the outlay that would be necessary on the part of the respective undertakers shows a saving of £1,401,892, an economy the benefit of which, according to the Act, is to be passed on to the consuming public in the form of cheaper supplies.

The Commissioners' estimate of the annual costs of generation falls from 0.4291d. per unit in 1930-31 to 0.3638d. in 1934-35. A surplus is shown on each year's work, after payment of administrative expenses, until 1934-35, when the capital charges on the new transmission system come into the account. From then onwards a gradually decreasing annual deficit is anticipated until 1939-40, when the tide turns, enabling a surplus of £44,586 to be anticipated in 1940-41 on an output of 3.220 million units, a uniform "unit charge" of 0.0425d. per unit being made from the commencement to cover the expenses of the Board.

With regard to the cost of power to the consuming public, Sir John Snell, the Chairman of the Commissioners, in the course of a short summary statement of the scheme, remarked that while in 1925-26 "the average charge per unit for all classes of use was 1.477d., it was hoped that under the new scheme, when fully developed, the charge would work out at "measurably under 1d. per unit," and that some big users would in all probability be able to obtain supplies at under ½d. per unit. As regards supplies for lighting purposes, such consumers, whose demands on the power stations only represent from one-fifth to one-quarter of their working periods, must, in view of this, and also having regard to the costly pressure-reduction plant and low-pressure distribution systems necessary in respect of lighting current supply, realise the fact that the charge must always be considerably above the average, although it was anticipated that the rate would be only 4d., and possibly 3d., per unit.

Following the usual opportunity for authorised undertakers to make representations on or against the scheme, it will be adopted either with or without modification by the Central Board, which will then proceed with the work of putting it into operation. Published coincidentally with the White Paper outlining the scheme, the Commission, as has already been indicated, has issued a Blue Book containing a series of Supplementary Particulars in which is outlined a plan of working the selected stations, together with the necessary estimates. Although based on exhaustive inquiries into the project, these are, of course, put forward merely as suggestions, since the practical working of the scheme, including the fixing of tariffs, is the responsibility of the Central Board. There is, however, a mass of interesting and instructive information in the Supplementary Particulars beyond that to which reference can here be made. It may, therefore, be mentioned that copies of the same, and also of the scheme, can now be obtained from H.M. Stationery Office.

The Commissioners have in preparation other schemes dealing with organised electricity supply in North-West England and North Wales; in North-East England, including Yorkshire and Lincolnshire; in South Wales; and in Southern and Western England, it being probable that details of the first two will be available in the near future.

The Overhead Lines Association.

The Joint Use of Wood Pole Lines for Electricity Supply and Communication Systems.

At the meeting of the Overhead Lines Association which was held at the Institution of Electrical Engineers, London, on Wednesday, March 14th, Mr. E. S. Byng, of the International Standard Electric Corporation, read a paper on the subject indicated in the title.

In view of the anticipated growth in electric power lines in this country, it might be assumed, said the author, that many of the existing restrictions would be withdrawn in order to facilitate and cheapen the erection of such lines. The present moment, therefore, was opportune to take account of American experience. At the outset of electricity supply and telephone and telegraph development there there were practically no restrictions or regulations of any kind, each utility company being permitted to erect its lines as it found convenient and necessary, the result being that various classes of plant were brought into existence which were essentially objectionable. The electricity and telephone companies each served the community by means of separate pole lines, the electric supply poles on one side of the road and the telephone poles on the other. In order to reach customers on both sides of the roads, some of the service wires of the telephone company had to pass over or under the electric supply company's wires, and *vice versa*. There were also many points of crossing of the main lines, which resulted in a general interweaving of both classes of plant with clearances and separations that were difficult or impracticable to control. These difficulties were augmented by the absence of any specification or rules to govern the relation of the two plants, and frequently it was impracticable to secure sufficient clearance between the two sets of service wires. In some cases, owing to physical obstructions, it was necessary for both sets of poles to occupy the same side of the road, and then it was difficult to maintain adequate vertical separation between the two classes of wires, and the wires of the lower pole line frequently interfered with linesmen climbing to the wires of the upper pole line.

As the result of the difficulties encountered, and complaints from local authorities, some of the supply companies and telephone companies agreed locally to use the same poles for their respective plant, and gradually a system was evolved for the use of joint lines which reacted favourably on the two services and decreased the construction and maintenance costs. All the experience gained showed that the joint use of poles under proper specifications offered a satisfactory solution of many of the difficulties of pole construction, not only in rural parts, but in the smaller towns and suburbs.

Since the joint use of poles started more than 15 years ago in America there had been a revolutionary change in construction methods. The National Electric Light Association, representing the majority of the supply companies, and the American Telephone and Telegraph Co., representing the various Bell telephone companies, had prepared a set of specifications which permitted the same pole to be used for both purposes. This scheme provided for the telephone companies

replacing a large amount of open wire by aerial cable, thus considerably reducing the number of wires on the poles, whilst the electric supply companies agreed to put their main feeders underground, simply using the overhead routes for distribution to the consumers. It was also agreed that the actual distribution of both electric and telephone services should be by means of covered drop wires between the last pole and the residence concerned. Practically the whole of the distribution work in America is now based upon the joint-use principle wherever circumstances necessitate this construction.

Giving a few details of the joint specification, Mr. Byng said there were limits as to the voltage and current permitted in this joint use arrangement. Supply circuits were grouped as Classes B and D, and communication circuits as C and P.

Fig. 1.—Pole with Supply Lines at Top, Telephone Cable (protected by Guard Arm) Below.

Class B covered circuits not exceeding 5,000 volts a.c. between wires or 2,900 volts to earth, and also d.c. street-lighting circuits not loaded above 7.5 A. Class D covered d.c. trolley wires not exceeding 750 volts to earth. Lines working at higher voltages than those mentioned were considered high pressure and were carried on separate routes. Classes C and P covered the communication and signal circuits for commercial use and private use respectively. A large number of lantern slides were shown; figs. 1, 2 and 3 give an indication of the manner in which this work is carried out.

The possibility of accident risk due to the joint use of poles had been very carefully considered by committees formed in various parts of the country in connection with the "safety first" movement. The American Engineering Standards Committee had also interested itself in this question. The result had been that the specifications prepared and agreed by the utility companies were consistent with the National Safety Code of the American Bureau of Standards. The requirements had been tried out in various parts of the country, and the American companies claimed that the safeguards had been proved to be entirely adequate. This was confirmed by the Government annual reports regarding fatalities caused by electric shocks and burns from high-pressure lines. These reports showed that very seldom did a fatality occur on jointly used poles. A further confirmation of this was that the employés themselves did not consider that they were running any risk when working on joint-use poles.

In many cases of joint use, the conditions were such that inductive interference was not an important factor. The inductive effects from d.c. circuits were usually slight, and when the telephone circuits were in cable they were to a considerable extent shielded from the effect of the disturbing fields. In some cases, however, particularly where alternating-current power circuits and open-wire telephone circuits were concerned, serious inductive effects might be produced unless preventive or remedial measures were used. For the class of power circuit covered by the joint-use specifications, however, the preventive measures were usually not expensive or difficult of application. Each case was dealt with on its merits, the general requirement being that supply circuits should be constructed, operated, and maintained with due regard to avoiding or minimising interference.

Three methods of dealing with the financial arrangements arising out of the joint use were now in vogue, namely, (1) space rental, (2) permanent rights, and (3) joint ownership. In all three methods, preference was given to payment by way of the space reserved and not on the actual number of attachments existing at any time. Furthermore, the "space reserved" basis of payment encouraged and promoted looking-into the future and making plans for the ultimate arrangement, thereby minimising the shifting of attachments of one company to make room for the growth of another. From a careful analysis of a large amount of joint-use experience it appeared, said Mr. Byng, that a system of jointly used pole lines designed and laid out to accommodate as far as possible the ultimate needs of both utility companies was an equitable and satisfactory arrangement.

The secret of success of this system of joint use of poles in America was the degree of co-operation which had been developed between the various utilities concerned. When one company was about to build a new line or an extension, or to enter upon a general re-construction, it consulted the representatives of the other companies concerned, and the construction work was carried out on a mutually satisfactory basis from the points of view of convenience and interference. This led to the erection of the minimum number of poles for a given territory, in addition to giving greater satisfaction to the public and to the employés concerned.

Discussion.

Mr. W. FENNELL asked what was the factor of safety of the poles used in America. He believed the factors of safety of poles for power lines in this country were greater even than the Post Office factor of safety, because there were many more Post Office poles broken in storms than there were power line poles. We in this country suffered at the moment in respect of the lack of co-operation, because the position seemed to be the Post Office first and the rest nowhere, and this imposed an insuperable difficulty. Very often the power supply authority could not even get one side of the road because the Post Office was already on both sides. There were a few cases in this country, however, where telephone wires and power supply wires were on the same pole, and he knew of one instance which had been in existence for 10 years, and nobody seemed to have been hurt by it. Mr. Fennell showed lantern slides of such cases, one of which is reproduced in fig. 4. He said that he had some 3,000-volt wires on the top and low-pressure wires below, on the same pole.

Mr. MOORE mentioned a case in America where the same poles accommodated a 60,000-volt line on the top, a 30,000-volt line lower down, next a 400-volt distribution line, and underneath that a telephone cable.

Mr. MARKHAM said that with the factors of safety adopted in this country, the diameter of the pole required to do what was done in America would be such that the pole could not be obtained.

Fig. 2.—Supply Lines at Top, Street Lamp and Telephone Cable Below.

Fig. 3.—Supply Lines and Lamp at Top, Telephone Wires and Cable Below.

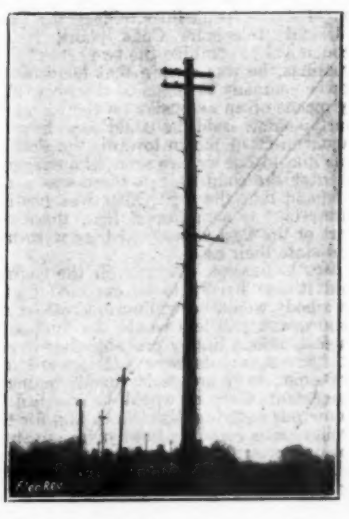


Fig. 4.—Supply Lines at Top, Post Office Wires Below.

Mr. W. A. Turnbull (Aylesbury) said that in connection with the work of rural electrification he was doing he had tried on one occasion to get the Electricity Commissioners to agree to the use of the earth as the return, but that was against the Post Office regulations, and supply people seemed always to be up against the Post Office. Supply engineers would have no objection to the Post Office running their wires on power poles without even a wayleave charge, and joint use would be an excellent thing in rural areas in this country.

Mr. W. C. Bexon said that although he was interested in the subject of the paper he did not think many people would like to see such a large number of poles erected in this country as was the case in America. On the general question, however, the Post Office was top dog here, and if the Association and the Post Office could discuss the matter together it would help a great deal. An instance of what happened was the case of a house a quarter of a mile away from his transmission line, to which he gave a supply by means of an overhead line. A week after he had completed the work the Post Office wrote to the effect that it was going to give a service to the same house, and would he therefore change over to an insulated wire. The result was that he had had to change over to insulated cable.

Mr. S. C. Bartholomew (Post Office) said he had understood that this was the "Overhead Lines Association," but he was inclined to think the name of the Association should be changed to that of the "Anti-Post Office Association," because at every meeting there was an attack on the Post Office. This idea of the general use of poles was a very old one, but the Post Office had given it up because in the early days when a high-pressure wire crossing a Post Office wire was on the same pole at crossings, with an insulated platform, two Post Office men were killed by electric shock. After the first fatality it was decided to put up a notice warning Post Office men how to work on these poles, but the man who was sent up to fasten the notice on a pole was killed because he did not observe the very directions on the notice he was affixing to the pole. At the present time the Postmaster-General did not object to an electricity supply line to a private house on private property being attached to the Post Office pole, and permission was frequently given for aerials to be fastened to Post Office poles. In cases where the Post Office pole was on the public highway, however, the consent of the highway authority had to be obtained, so that it was not merely a matter for the Postmaster-General. Joint use of poles, however, was quite common here, and there was one town where it was frequently done. As regarded the use of the earth return, mentioned by Mr. Turnbull, that was absolutely forbidden in America, and in this country the Commissioners as well as the Post Office forbade its use, because there were other people besides the Post Office who had signalling wires, such as the railways and private individuals. Moreover, he had not found the practice in favour in France, Germany, or Switzerland. The fact that the Post Office was sometimes on both sides of the road arose from the circumstance that at one time there were two services given, one by the National Telephone Co. and one by the Post Office, the latter at the time being the long-distance trunk lines. Since the Post Office took over the National Telephone Co.'s plant, it had not been found economical to combine the two sets of lines. As regarded road crossings, he was certain that facilities would be granted to a power company to fasten to the Post Office pole if it were done by means of an extension on the top of the pole. Finally, Mr. Bartholomew said he could not help feeling that the antagonism often shown towards the Post Office in these matters was due to one or two men who exaggerated; it did not exist all over the country, but there was a danger of its becoming a legend that the Post Office was hostile to electricity supply interests. As a matter of fact, there was no hostility on the part of the Post Office, but they were not allowed to advertise and state their case.

Mr. A. Lennox Stanton, in the course of a communication, said it was hardly to be expected that Post Office engineers as a body would be willing to agree to a joint use of their pole routes, and still less would the linesmen welcome it. Nevertheless, it was highly probable that if properly designed joint-pole arrangements were put forward for road, rail, or route crossings, such proposals would commend themselves and an agreement thereon would be reached. Again, there were numerous outlying districts calling for electricity supply where trolley poles could be used more advantageously than was the case at present, and there were numerous other areas which admitted of being economically served by electricity supply if only authority to erect poles on the free side of railways was obtained, for many miles of railway existed which did not carry pole lines on both sides As both reinforced-concrete and steel poles set in concrete bases were extensively used in other countries, the author's particular stress on "wood" poles in the title of his paper called for inquiry.

Mr. Bartholomew, in the course of some further comments, siaid that experience in America showed that, from the legal point of view, there was trouble from dual maintenance of poles.

Mr. Byng, replying to the discussion, said he believed the factor of safety asked for by Mr. Fennell was two, and this had been sufficient to meet the very much heavier storms which occurred in some parts of America, compared with this country. He remembered one or two cases in this country of joint ownership of poles which worked very well. In America, the telephone companies to-day did not use many open wires, as aerial cable had been largely standardised. In this country all the telephone work had been standardised by the Post Office, and it was very well done. On the other hand, there was not that same degree of standardisation in the case of power supply. For instance, at a town in Cornwall, he considered the overhead lines of the power supply authority were put up disgracefully. The poles did not seem to be more than scaffold poles, and the wires were not taut. Mr. Fennell's articles in the Electrical Review were the first serious suggestion for the standardisation of rural supplies. The reason for so many poles in America was that the whole thing had grown up bit by bit and had not been dealt with from the beginning in a comprehensive manner, but things were changing now in that respect. Joint use was being considered in Italy. The legal aspect of joint use was a simple one, because the poles definitely belonged to one authority which took a rent from the other, and it was because of difficulties of the kind outlined that the policy of reserved space had been adopted. Reinforced-concrete and iron poles were not used to any great extent in America, although the tendency would probably be more in that direction in the future, because of the plagues which had devastated some of the forests.

The Chairman, proposing a hearty vote of thanks to the author, mentioned that the Electricity Commissioners were dealing seriously with the question of rural supplies. The great difficulty was that the high-pressure lines must be installed first, and until that was done it would, of course, be impossible to distribute the current into the rural areas.

Electrodeposition of Silver.

Some Notes on the Proceedings at the Recent Joint Conference at Sheffield.

On February 17th, a joint conference on the electrodeposition of silver was held by the Electroplaters' and Depositors' Technical Society (London), the Sheffield Silver Trades Technical Society, and the Sheffield Section of the Institute of Metals, in the Mappin Hall of the Department of Applied Science of Sheffield University.

Prof. C. H. Desch, F.R.S., presided, supported by Mr. W. H. Bagshawe, president of the Sheffield Society, Messrs. S. Field and S. Wernick, president and hon. secretary, respectively, of the Electroplaters' Society. Two papers were presented to the meeting, the first on "Silver Plating," by Mr. C. Nicol, and the second on "Some Recent Work on Silver Plating," by Dr. E. E. Sanigar.

Mr. Nicol, in the course of his remarks, said that the earliest use of electro-plating was connected with the work of the silversmith, and its commercial possibilities were first visualised as a new means of covering base metals with silver. In the actual deposition it was possible to treat silver in ways which were altogether impossible with other metals, with the exception of gold. The process could be interrupted and restarted without harm to the deposit, and, indeed, where heavy deposits were desired, this interruption was necessary. While the constituents of silver-plating solutions were the same universally, the variations in the quantities of these were very wide indeed. It was found that the silver content varied from 5 dwt. to as much as 6.0 oz. per gal. The higher figures indicated the need for some method of preventing the silver content from increasing; they were not necessary, and, in the case of large plants, represented a serious addition to capital outlay. For many years past the addition of more free cyanide had been regarded as the grand specific for all the ills to which a cyanide solution was heir, and it was fairly safe to say that a considerable portion of the cyanide which had been introduced into silver solutions had been wasted. The quantity of free cyanide present should bear a definite relationship to the silver present, and also to other factors. An excess of the free-cyanide content above 50 per cent. resulted in the formation at the anode of a very troublesome substance which appeared to be silver peroxide. The chief effects of the presence of carbonate were: Increase in the conductivity of the solution; a finer crystalline structure of the deposit; and increased "throwing" power. Probably the finer crystalline structure resulted from the increased conductivity which, of course, meant a decrease of e.m.f.

Dr. Sanigar dealt with the hardness of the silver deposit; the best method of measuring the hardness was scratching the deposit with a diamond under a suitable load. The results of the work showed that to obtain a good deposit about 50 gm. of sodium carbonate per litre was essential. Although blackening of the anodes became less noticeable at higher free-cyanide contents, the bright area increased. At 600 per cent. excess free-cyanide a peculiar bright deposit was obtained which had a very fine crystal structure and none of the undulations which characterised the ordinary silver deposits.

In the discussion which followed the papers, Mr. R. Barklie said it was important to distinguish the volts between the anode and the cathode bars from the volts between the solution covering the cathode and the cathode itself. In regard to the behaviour of silver anodes, the speaker said that Mr. Nicol, Dr. Sanigar and himself had taken up the subject some time ago. It had been possible for them to show the visiting members before the meeting three examples, namely (a) a sil-

ver anode working normally, (*b*) a silver anode covered by a thick black layer, the overall pressure being about 30 volts, and (*c*) an anode showing a periodical darkening and clearing, the darkening being accompanied by a drop, and the clearing by a rise, in the current passing. The effect occurred in periods of about two seconds, and the same sample of fine silver and the same bath were used for each experiment. Mr. HOTHERSALL, referring to Mr. Nicol's argument that increase in conductivity improved the throwing power of the solution, said that so far as he knew there was no published work on the subject, except possibly that of Foerster, who gave two curves which showed that the throwing power was much worse at a higher temperature than it was at the lower one. The effect of the cathode potential on current density was obvious.

Mr. DONALD WILSON said that during the last ten years the silver refiners had analysed a great number of anodes, and the question of their purity was a frequent bone of contention. They had never found them to come less than 999 parts of fine silver per 1,000, and they had traced no cause of trouble to metallic impurities in the silver. He also referred to the annealing of the anodes, and wondered whether the researchers who had been working for that meeting had inquired as to whether the hardness tests had been tried with different annealing conditions of the anode, or whether the anodes had been entirely excluded as a possible cause of the trouble. It was important that they should know whether the platers must have a certain annealing condition, or whether if they were evenly annealed the size of the crystalline structure was of any importance.

Mr. WERNICK said that he had been struck by the fact that Mr. Nicol had pointed out that the silver plating solutions might vary considerably in their constituents and yet give an equally good deposit. Dr. Sanigar had shown that the physical properties of this deposit might vary very much with these same constituents. On the whole there was certainly a field for the technical man even in the silver-plating industry. He wondered whether they would ever come down to a nitrate deposit which might be used commercially.

Mr. NICOL, in reply, said that in the carbonate-conductivity experiments a constant free cyanide content of 90 per cent. was used, which was a fairly high figure. He agreed that much of the anode trouble was due to annealing, and also that "throwing power" was not simply a question of current density. Copper was always present and seemed to have no other effect than increasing conductivity.

A New Wiring System.

A new scheme, employing metal-sheathed cables, which has been introduced by Messrs. Wm. Geipel, Ltd.

THE "Geipel" wiring system employs metal-sheathed cables and is designed primarily to give the maximum efficiency in the interconnecting of the conductors and the bonding and earthing of the sheathing. It includes a junction box in which porcelain connectors and bonding clamps are employed, and a bonding bar.

The junction box, fig. 1, consists of a bonding plate and cover and is provided with two, three, or four points of entry,

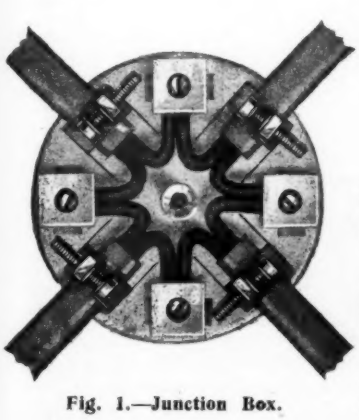


Fig. 1.—Junction Box.

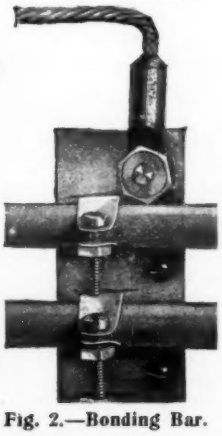


Fig. 2.—Bonding Bar.

either from the surface or the back. Tongues are formed in the bonding plate to which clamps are attached for the bonding and fixing of the cable. For back entry the tongues of the base plate are bent forward at right angles, leaving clear holes for the cable entry. Slots in the cover are formed by bending back the sheared pieces at as many points as necessary to suit cable entries. The bonding clamps are slipped over the sheathing of the cable, the lower portion being passed beneath the tongues of the bonding plate. Tightening up of the clamp presses the metal sheathing of the cable into firm contact with the bonding plate, giving, it is claimed, good electrical contact and firm fixing. The porcelain connectors are of ample capacity for wiring and well proportioned for convenient handling. They are specially constructed so as to fit into slides on the bonding plate, by which means they are firmly held and properly positioned. This enables the wires to be permanently laid in the most suitable manner within the box.

The bonding bar, fig. 2, is used where a number of converging cables are to have their sheathings bonded and earthed as, for example, near a distribution box. The bars are made in standard lengths of 12 in. from which can be cut or broken suitable lengths according to the number of wires or cables to be dealt with. The method of bonding is the same as that used with the junction box. Two of the holes in the bar are used for fixing screws, a further hole being fitted with the main earthing terminal bolt.

Legal.

La Radiotechnique v. P. & W. Weinbaum.

MR. JUSTICE TOMLIN, in the Chancery Division on March 15th, had mentioned to him for settlement an action by La Radiotechnique, a French company, against Philip and William Weinbaum, Mile End, E., for injunctions restraining infringement of the plaintiffs' trade-mark for wireless valves, restraining the sale under the descriptions "Radio Micro" and "Radio Micro Special" of valves so closely resembling the plaintiffs' goods as to be calculated to deceive, and also restraining the use of cartons for packing the valves, which were a colourable imitation of the plaintiffs' cartons.

Mr. CORSELLIS, for the plaintiffs, said the defendants agreed to submit to injunctions and to pay £155 as costs.

His LORDSHIP said the injunction with regard to the cartons would be to restrain the use of cartons for the sale of goods not the plaintiffs got up in a form calculated to lead to the belief that the goods were the plaintiffs. By consent there would be injunctions against the defendants, and an order for payment of the agreed sum as costs, and for the delivery up of all infringing articles.

British Thomson-Houston Co., Ltd., v. Amalgamated Lamp Co. (Gt. Britain), Ltd.

AN injunction was granted in the Chancery Court on March 16th by Mr. Justice Clauson in the matter of the British Thomson-Houston Co., Ltd., against the Amalgamated Lamps Co. (Great Britain), Ltd., Finsbury Pavement, E.C.

For the British Thomson-Houston Co., Mr. DREWE said the infringement complained of was of the two usual patents, the plaintiffs' letters patent for the gasfilled lamps, and the leading-in wires. The defendants were not represented in Court. There had been a large number of actions, now, taken by the British Thomson-Houston Co. in respect of these patents against different defendants, and the validity of the patents had been affirmed by the House of Lords and Mr. Justice Astbury.

Mr. Justice CLAUSON said the plaintiffs would have their injunction against the defendants, and the plaintiffs' costs of the motion would be costs in the action.

General Radio Co., Ltd.

THE petition for a compulsory order to wind up the General Radio Co., Ltd., presented by H. Clarke & Co. (London), Ltd., again came before Mr. Justice Eve in the Companies' Winding-up Court on March 19th. Mr. BEEBLE, for the petitioners, said that the petition had been standing over in order that a meeting of creditors might be held so that their views should be ascertained. At the meeting a resolution was passed requesting that the petition should be adjourned for a further month while negotiations for the sale of the assets proceeded.

Mr. BRAUND, for the company, said that seven of the largest creditors had formed themselves into a committee of inspection, and the largest creditor had become a member of the board. In these circumstances the company was very hopeful that the negotiations would go through and the creditors would be paid in full.

Mr. Justice EVE directed the petition to stand over until the second petition day of next sittings.

Overhead Line Dispute.

BEFORE the Railway and Canal Commission last week the Houghton Main Colliery Co. applied for an order under the Mines (Working Facilities and Support) Acts and the Mining Industry Act. The applicants said that they made an agreement to take a supply of electricity from the Carlton Main Collieries by means of an overhead line. They had secured the verbal permission of Mr. C. A. White (the respondent) to erect standards and carry the line over land belonging to him. Mr. White now denied giving that permission, and claimed damages. The company asked the Commission either to say that it was in the right or relieve it of the consequences of the trespass if it was wrong.

Mr. Justice SALTER fixed the hearing of the application for May 1st.

The Electrical Imports of India.

Principal Sources of Supply.

FULL details of India's import trade in 1926-27 in electrical goods, showing the principal countries of supply, have recently been issued. From these the following particulars have been extracted. The corresponding figures for 1925-26 have been added for purposes of comparison and a note of increases or decreases given :—

	1925-26. Rs. (Thous.)	1926-27. Rs. (Thous.)	Inc. or dec. Rs. (Thous.)
Control and switchgear—			
Total	3,640	3,240	− 400
From United Kingdom	3,253	2,900	− 353
„ United States	139	169	+ 30
Generators, alternators and dynamos—			
Total	4,193	4,942	+ 749
From United Kingdom	3,684	4,500	+ 816
„ United States	196	270	+ 74
„ Switzerland	47	8	− 39
„ Germany	175	150	− 25
„ Italy	17	5	− 12
Motors—			
Total	3,459	2,935	− 524
From United Kingdom	2,747	2,327	− 420
„ United States	330	373	+ 43
„ Sweden	65	15	− 50
„ Germany	166	134	− 32
„ Switzerland	21	11	− 10
„ Italy	37	24	− 13
Transformers—			
Total	1,849	2,304	+ 455
From United Kingdom	1,339	1,679	+ 340
„ United States	384	505	+ 121
„ Germany	101	105	+ 4
„ Italy	3	—	− 3
„ Holland	12	4	− 8
Turbo-generator sets—			
Total	2,760	771	−1,989
From United Kingdom	2,564	677	−1,887
„ Germany	119	2	− 117
„ United States	52	76	+ 24
Other electrical machinery—			
Total	6,333	8,744	+2,411
From United Kingdom	4,807	6,519	+1,712
„ United States	872	873	+ 1
„ Switzerland	6	7	+ 1
„ Germany	231	568	+ 337
„ France	4	30	+ 26
„ Italy	28	48	+ 20
„ Belgium	30	242	+ 212
Electric fans and parts—			
Total	2,825	3,187	+ 362
From United Kingdom	1,617	2,121	+ 504
„ Italy	635	602	− 33
„ United States	205	156	− 49
„ Germany	350	278	− 72
Wires and cables, rubber insulated—			
Total	3,715	3,035	− 680
From United Kingdom	3,379	2,832	− 547
„ United States	24	33	+ 9
„ Germany	202	121	− 81
Ditto, other insulation—			
Total	2,286	2,926	+ 640
From United Kingdom	2,109	2,611	+ 502
„ United States	5	144	+ 139
„ Germany	80	122	+ 42
„ Holland	54	25	− 29
„ Belgium	11	6	− 5
Telegraph and telephone wires and cables—			
Total	163	97	− 66
From United Kingdom	162	83	− 79
„ Germany	—	11	+ 11
Bare copper wire, electrolytic, other than telegraph and telephone wire—			
Total	1,538	2,087	+ 549
From United Kingdom	1,158	1,579	+ 421
„ Germany	193	129	− 64
„ Holland	83	117	+ 34
„ Japan	51	—	− 51
Telegraph and telephone instruments and apparatus—			
Total	770	477	− 293
From United Kingdom	702	402	− 300
„ United States	20	22	+ 2
„ Sweden	27	48	+ 21
„ Germany	16	1	− 15
Electric glow lamps—			
Total	2,001	2,065	+ 64
From United Kingdom	791	788	− 3
„ Holland	565	768	+ 203
„ Germany	147	135	− 12
„ Austria	182	160	− 22
„ United States	54	31	− 23
Electric lamps, other sorts—			
Total	474	1,099	+ 625
From United Kingdom	46	62	+ 16
„ Germany	52	69	+ 17
„ United States	349	205	− 144
Batteries—			
Total	889	1,017	+ 128
From United Kingdom	430	396	− 34
„ United States	216	432	+ 216
„ Germany	241	185	− 56
Electric carbons—			
Total	63	64	+ 1
From United Kingdom	41	40	− 1
Accumulators—			
Total	1,216	1,670	+ 454
From United Kingdom	902	1,435	+ 533
„ United States	89	104	+ 15
Electric condensers (nearly all from U.K.)—			
Total	26	182	+ 156
Electric bell apparatus—			
Total	18	8	− 10
From United Kingdom	7	1	− 6
„ Germany	10	3	− 7
„ United States	1	3	+ 2
Lighting accessories and fittings, including switches—			
Total	1,613	1,506	− 107
From United Kingdom	941	1,092	+ 151
„ Germany	197	273	+ 76
„ United States	428	93	− 335
Meters—			
Total	630	551	− 79
From United Kingdom	462	459	− 3
„ Germany	93	48	− 45
„ Switzerland	49	9	− 40
„ United States	15	33	+ 18
Electro-medical apparatus—			
Total	284	176	− 108
From United Kingdom	112	45	− 67
„ United States	117	60	− 57
„ Germany	14	11	− 3
„ France	32	47	+ 15
Switchboards (other than telegraph and telephone)—			
Total	321	409	+ 88
From United Kingdom	305	395	+ 90
„ United States	4	11	+ 7
„ Germany	8	2	− 6
Electrical goods and apparatus, unenumerated—			
Total	2,966	3,625	+ 659
From United Kingdom	1,810	2,273	+ 463
„ Germany	489	551	+ 62
„ United States	376	584	+ 208
„ Japan	163	109	− 54

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

More Points on Studying.

In your issue of February 17th "'Ric" has given some very useful hints to the practical man whose ambition, or mere desire to understand his job, turns him into a spare-time "swotter." If such a man is not too much in the clouds and is tackling a subject more or less in touch with his daily work, he will find that knowledge of a peculiarly reliable and unforgettable nature will be absorbed—much of it almost instinctively and without effort.

I feel that while "'Ric" indicated many of what one might call the technical ways-and-means of studying, he has been remiss in one particular: no mention was made of environment. For most of us a quiet atmosphere and, if not solitude, at least the companionship of kindred spirits are essential. Work *of a kind* can be done amid disturbance—but not sustained and effective work.

Most of the fellows both "'Ric" and I have in mind are in their twenties: they may or may not have had a thorough general and technical education, but they are now, whilst newly entered upon their careers, taking full or "refresher" courses. Some of them will still be at home or (with a hardihood or pecuniary luck unusual in engineers) have married and founded their own; and as a rule these study-volunteers have fairly congenial surroundings wherein to "mug up" facts. I say "as a rule"—but relatives (on the score of acerbity or numbers), musical neighbours, and even luxurious sitting-accommodation can play havoc with a fellow's determination.

My sympathies are not for these, but for all those wanderers who, fresh from home and still heartsick, or case-hardened and comparatively old stagers, are grimly tackling their books in lodgings. Lodgings, it has been said, are either bad or indifferent, and the significance of this comfortless saying becomes only too apparent when one gets the studying craze.

The increasing distractions of our age plus the formidable breadth even of speciality subjects are tremendous handicaps to any young man or woman who, after a day's work, continues that work in another form; but when the spare-time efforts have to be exerted in dispiriting surroundings they become almost heroic.

Undoubtedly, as "'Ric" advocates, pre-breakfast work is the best. The mind is then fresh and receptive, and new facts can be thought over and memorised during the day—with a short "topping-up" to follow in the evening before early bed. Many earnest "swotters" who are handicapped by ineffective evening work and even subsequent insomnia are urged to try the early-rising method; aided and abetted by a merciless repeater alarm-clock, let them make a start with a quarter of an hour's work, and gradually lengthen the amount.

"'Ric" suggests that journals and the like should be kept, but at home, and especially in "digs," this is not always possible or advisable. Cut out one's own special subjects and keep every index by all means. Tuition by correspondence, especially in the shape of refresher courses or when taken by men on shift duties, is often a godsend: it is a pity that fees are so high—high, that is, for the average young engineer.

G. E. Moore.

Newcastle-upon-Tyne, *March 8th*, 1928.

"Fair Trading."

I quite agree with "Manotescon's" remarks, but would like to point out that the manufacturer's chief difficulty in remaining in the (*a*) class is the practical impossibility of his imposing his reselling terms and prices on the wholesaler.

I feel sure that if the wholesalers would continue in guaranteeing to maintain the said terms, little would be heard of manufacturers selling their products promiscuously and taking no interest in subsequent sales.

Manufacturer.

Insulation Impregnation.

Having had occasion in previous correspondence to question the somewhat extravagant, if not fantastic, claims made for synthetic varnishes worked by the M.A.X.E.I. process, the writer was not surprised to see in your issue of the 16th inst. an admission by Mr. Dunlap that he had "made no attempt to treat exhaustively the whole subject."

It is difficult to understand the necessity for this complicated elaboration to attain results which are most easily and simply obtained by good-quality grease or oil varnishes in apparatus capable of being constructed with a little mechanical knowledge and the ordinary facilities of an engineering workshop.

Synthetic resins are most useful, and have a very wide field of application in the form of moulded articles and built-up insulation generally, but as a medium for impregnating windings they are decidedly undesirable; the best testimony to this is the fact that they have been completely abandoned for such purposes in America, and the same state of affairs is fast approaching consummation in France.

British manufacturers who are now called upon to build plant and apparatus (particularly transformers) for extreme high pressures and large outputs would be well advised to institute inquiries as regards the experience of the two countries named, if they would wish to avoid the troubles which have ensued from the use of synthetic varnishes.

C. W. Crosbie.

Northampton, *March 19th*, 1928.

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 14th:—

Trivector. No 485,646. Class 8. Electricity meters for ordinary power supplies.—Société Landis & Gyr, Zug, Switzerland. (British representatives: H. A. Gill & Co., 51-52, Chancery Lane, W.C.2.)

Crusader, No. 467,931, and Globe Trotter, No 467,932. Class 8. Thermionic valves and radio receiving sets.—A. C. Cossor, Ltd.

Duke of Wellington (head design only). No. 485,923. Class 13. Electric lamps (ordinary).—L. L. Lloyd, trading as the Wellington Lamp Co., 3, Waterloo Road, S.E.1.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1926.

20,286. "Electrical signal amplifying and repeating system." B. F. Miessner. August 17th, 1925. (256,994.)

20,931. "Electrical driving of spindles for spinning or other textile processes." British Celanese, Ltd., and E. C. Cope. August 25th, 1926. (285,927.)

26,367. "Electricity prepayment meters." British Insulated Cables, Ltd., and L. B. Wilson. October 22nd, 1926. (285,937.)

26,658. "Electric fires." J. Y. Fletcher and F. G. Quance. October 25th, 1926. (285,943.)

27,165. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and W. O. Passmore. October 29th, 1926. (285,947.)

29,267. "Apparatus for transmitting and receiving telegraphic messages in code." A. G. Damm. November 19th, 1926. (285,955.)

29,336. "Electric vacuum cleaners." S. McClatchie. November 20th, 1925 (261,780.)

29,698. "Automatic control systems for dynamo-electric machines." British Thomson-Houston Co., Ltd., and C. J. Sarjeant. November 23rd. 1926. (285,971.)

29,652. "Thermionic valves." Edison Swan Electric Co., Ltd., and T. W Price. November 23rd, 1926. (285,975.)

29,730. "Electric condensers." W. E. Barber. November 24th, 1926 (285,980.)

29,756. "Apparatus for carrying galvanic batteries." Oldham & Son, Ltd., and G. L. Darby. November 24th, 1926. (Cognate application, 19,728/27.) (285,985.)

29,812. "Fittings for use in connection with electrical wiring systems." J. A. Crabtree. November 25th, 1926. (285,989.)

29,824. "Means for detecting and approximate measurement of electrical leakage." A. G. Bullen. November 25th, 1926. (285,990.)

29,858. "Battery boxes or cells." J. Stone & Co., Ltd., A. H. M. J. Ward, and S. C. Davy. November 25th, 1926. (285,993.)

30,011. "Electrical convertors, transformers, and the like." R. M. Wilmotte. November 27th, 1926. (286,001.)

30,174. "Electrical heaters." C. B. Backer. November 29th, 1926 (286,008.)

30,190. "Electric signalling or control systems." A. Reyrolle & Co., Ltd., and R. Willoughby. November 29th, 1926. (286,011.)

30,429. "Electric motor controllers." British Thomson-Houston Co., Ltd., and C. T. Hanna. December 1st, 1926. (286,014.)

31,298. "Automatic electrical motor-controlling systems." J. Lithgoe and H. Tinsley. December 9th, 1926. (286,022.)

31,581. "Push-button switch." N. Lehnert and A. Paulus. December 13th, 1926. (286,026.)

32,645. "Electric switching devices." M. Payne. December 24th, 1926 (286,033.)

1927.

9. "Junction boxes for electric cables." Walsall Hardware Manufacturing Co., Ltd., and A. E. Read. January 1st, 1927. (286,035.)

670. "Electrical systems of selection useful for indicating or signalling purposes." General Electric Co., Ltd., and H. G. Cheel. January 10th, 1927. (286,044.)

806. "Electric wiring or fittings therefor." T. Roberts. January 11th, 1927. (286,045.)

1,182. "Electric switches." Kersons Manufacturing Co., Ltd., and C. W. Parsons. January 14th, 1927. (286,046.)

1,367. "Formation of coils for wireless and other electrical apparatus." F. Rogers and E. H. Griffiths. January 17th, 1927. (286,047.)

1,655. "Electric switches and switchgear." F. B. Cox. January 20th, 1927. (286,051.)

1,992. "Electrical fuses or cut-outs." Midland Electric Manufacturing Co., Ltd., and W. L. Barber. January 24th, 1927. (Addition to 241,322.) (286,053.)

2,356. "Control of radio or wireless receiving sets." E. Whiteley and W. Mould. January 27th, 1927. (286,055.)

4,730. "Construction of pressure-tight casings." English Electric Co., Ltd., and J. P. Chittenden. February 19th, 1927. (286,076.)

5,056. "Head telephones." Lissen, Ltd., and R. P. Richardson. February 22nd, 1927. (286,081.)

5,944. "Conduit system and means for distributing electric circuits in buildings." J. Reah (Walker Bros.). March 3rd, 1927. (286,090.)

6,509. "Multiple valve amplifiers." Dr. S. Loewe. March 8th, 1926 (267,167.)

9,131. "Electric token apparatus for railways." Tyer & Co., Ltd., and F. W. Leake. April 2nd, 1927. (286,108.)

12,555. "Loading coils for duplex telephone circuits." Siemens & Halske Akt.-Ges. May 19th, 1926. (271,456.)

13,033. "Self-induction coils." Siemens & Halske Akt.-Ges. June 17th, 1926. (Addition to 271,456.) (272,873.)

14,835. "Spark-gap oscillation-producing apparatus especially suitable for electric high-frequency furnaces." R. Dufour. June 8th, 1926. (272,495.)

15,301. "Electric conductors." A. Hart. June 9th, 1927. (286,135.)

16,355. "Searchlights." Siemens-Schuckertwerke Ges. and O. Krell June 20th, 1927. (286,138.)

17,173. "Load-control systems for electric power plant." British Thomson-Houston Co., Ltd. June 30th, 1926. (273,717.)

17,431. "Apparatus for mechanically mounting wires or helices in wire supports with loops of electric lamps or similar devices." Naamloore Vennootschap Philips' Gloeilampenfabrieken. July 10th, 1926. (274,071.)

18,256. "Application of Hall effect and similar electrical phenomena to radio and allied subjects." P. H. Craig. July 9th, 1926. (274,112.)

18,509. "Electric meters." British Thomson-Houston Co., Ltd. June 12th. 1926. (274,134.)

18,697. "Electric circuit interrupters." British Thomson-Houston Co., Ltd. July 28th, 1926. (275,208.)

19,608. "Electrical depositing of chromium." Siemens & Halske Akt. Ges. July 27th, 1926. (275,223.)

20,220. "Lead-in insulators particularly for electric apparatus." Siemens-Schuckertwerke Akt. Ges. August 10th, 1926. (275,966.)

20,355. "Electric waffle-irons." British Thomson-Houston Co., Ltd August 2nd, 1926. (275,265.)

22,366. "Illuminating appliances." Holophane, Ltd., and S. English. August 25th, 1927. (286,161.)

23,252. "Metallic cores for electromagnets or the like." J. Y. Johnson (I. G. Farbenindustrie Akt. Ges.). September 5th, 1927. (Addition to 269,770.) (286,167.)

25,145. "Thermionic valves and other electron-discharge tubes and cathodes therefor." Allgemeine Elektricitäts Ges. September 23rd, 1926. (277,997.)

26,050. "Radio receivers of the super-heterodyne type." L. Levy. October 13th, 1926. (279,064.)

26,188. "Cooling arrangement for electric motors driving multi-stage force pumps." Maschinenfabrik Oerlikon. October 18th, 1926. (279,065.)

26,327. "Selectors for telephone systems." Siemens & Halske Akt. Ges. October 9th, 1926 (278,717.)

26,443. "Manufacture of metallic beryllium or its alloys by means of the electrolysis of a molten mass." Siemens & Halske Akt. Ges. October 7th, 1926. (278,723.)

26,826. "Electric means for re-energising the driving springs of clock-work mechanisms." Schlo et Cie. December 15th, 1926. (282,350.)

1928.

1,180. "Manufacture of electric incandescent lamps and the like." General Electric Co., Ltd. January 19th, 1927. (283,890.)

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—259 houses (£72,960) for Corporation; city engineer.

ABERGELE.—Sanatorium extensions (£100,000); Manchester Corporation.

AUDENSHAW (MANCHESTER).—Secondary school for Lancs. Education Committee; director of education, Preston.

BADSEY (WORCS.).—Practical subjects centre; W. A. Cox (Evesham), Ltd.

BARNSLEY.—Covered market; borough engineer. Hall and library, Ardsley area; Stairfoot Miners' Welfare Committee and Corporation Libraries Committee.

BEACONSFIELD (BUCKS.).—Housing scheme (50), for the U.D.C.; surveyor. Shops, offices, and flats, Market Place, for the Arterial Road Building Syndicate.

BRADFORD.—240 houses, White Abbey area; city architect. Proposed extensions to the King's Hall Central Baths (£7,600); city architect, Town Hall.

BRISTOL.—Housing schemes on 86 acres at Fishponds, Speedwell and Horfield; city engineer. 30 houses, Parson Street, Bedminster; Greenhill & Low, Ltd. Municipal office accommodation, St. Stephen's Street; city engineer.

BROADSTAIRS.—Wireless station, North Foreland, for H.M. Office of Works, King Charles Street, S.W.

BURY ST. EDMUNDS.—Business premises, Cornhill, for F. W. Woolworth & Co., Ltd., bazaar proprietors, Kingsway, London.

BUSHBURY (WOLVERHAMPTON).—Housing scheme (120), Fordhouses, for Bushbury Estates & Building Co.

CARLISLE.—54 houses, Duke Street and Rigg Street; city engineer.

CHESTERFIELD.—Additional 47 houses, for the T.C.; borough surveyor.

CREDITON.—Electric light installation, Institution, for the B.G.; clerk.

CROYDON.—Additional 70 houses, Hermitage Road estate, for the T.C.; borough engineer.

DEWSBURY.—Hospital reconstruction; Joint Hospital Board

DONCASTER.—Joint mental hospital; Corporations of Doncaster, Rotherham, Halifax, Huddersfield, and Dewsbury.

EASTLEIGH (HANTS.).—Tire factory; Pirelli, Ltd.

EDINBURGH.—Telephone exchange at Davidsons Mains; Commissioners of H.M. Works and Public Buildings.

EDWINSTOWE.—Houses (100), for the Bolsover Colliery Housing Co., Ltd.; Percy B. Houfton & Co., architects, Market Place, Chesterfield.

FARNHAM ROYAL (BUCKS.).—Alterations and additions, Farnham Chase, for Sir Gomer Berry.

FIFESHIRE.—Renovation of U.F. Church at Kinghorn; the Minister. New building at Burntisland Higher Grade School (£4,500); clerk, Education Authority, Kirkcaldy.

FLEETWOOD.—Central school (£26,000); Lancashire Education Committee.

FRIMLEY.—Houses (50), for the U.D.C.; Capt. R. H. Porteous, surveyor.

GILLINGHAM (KENT).—Houses (47) and 15 shops, for S. L. Redford; C. W. W. Thompson, architect.

GLASGOW.—Warehouse at Wilson Street for G. J. and D. K. Todd, 71, Candleriggs. Garages at St. Vincent Crescent for Glasgow General Omnibus and Motor Services, Ltd.; the manager. 446 houses for Corporation; city architect. Warehouses and shops at Glasgow Cross for Corporation (£60,992); city architect. New secondary school in Hyndland (£60,000); clerk, Education Authority, Bath Street. 248 steel houses, Corporation estates; Atholl Steel Houses, Ltd. Extensions, Glasgow Eye Infirmary, Sandyford Place; Governors.

GRAVESEND.—Garage, New Road; Kent and Essex Motors, Ltd.

GUILDFORD.—Assize Court (£40,000); S. Tatchell, architect

HALIFAX.—Hotel, Glendinning & Hanson, architects, 15, Commercial Street. Shopping arcade, King Cross, for the Industrial Society, Ltd.; Jackson & Fox, architects.

HAMILTON.—Picture house, for Hugh Niven Bryden. Balmyre, Motherwell.

HASTINGS.—Bank, Grand Parade; F. G. R. Palmer, architect. Alterations, Alexandra Hotel, Eversfield Place; Callow & Callow, architects.

HAYES (MIDDLESEX).—Houses (200), for the U.D.C.; R. S. Davey, surveyor.

HESWALL (BIRKENHEAD).—Cinema, Telegraph Road, for J. Pye.

HONLEY.—Secondary school (£41,500); West Riding Education Committee.

HULL.—Secondary school, Pickering Road; city architect.

IRISH FREE STATE (MILLSTREET, CO. CORK).—Church. Ballydaly Cross; M. O'Connor, architect, 29, South Mall, Cork.

(CASTLELAND, CO. KERRY).—Church, Scartaglin; M. O'Connor, architect, 29, South Mall, Cork.

IVER (BUCKS.).—Additions, Heatherden Hall, for Col. W. G. Morden, M.P.

KINGSWINFORD.—Three schools, for Staffs E.C.; Eustace Joy, clerk, Stafford.

LEEDS.—Corporation houses on Meanwood, Middleton, and York and Selby Road Estates; city engineer, Municipal Buildings.

LONDON (HACKNEY, E.).—Factory, Middlesex Place; Crockmay & Wintle.

(STAMFORD HILL, N.).—Cinema, Amhurst Park; W. E. Trent.

(ST. MARYLEBONE, N.W.).—Rebuilding scheme, Marylebone Road; George Head & Co Buildings, 43-46, Portman Square and 18, Orchard Street; Messrs. Joseph.

(LEWISHAM, S.E.).—62 houses, L.C.C. Downham Estate; J. G. Stephenson.

(KENSINGTON, S.W.).—Dwellings, Dalgarno Gardens; Sutton trustees.

LUTON.—Works extensions, for B. Laporte, Ltd.

MANCHESTER.—Schools, Withington, Kingsway, and Ran's Wood Estates; S. Hey, director of education, Education Offices, Deansgate.

MIDDLESBROUGH.—Boys' secondary school, Linthorpe, for the Borough E.C.; director of education.

MITCHAM.—Factory for the Mullard Radio Valve Co., Ltd.; Welwyn Builders, Ltd., contractors.

NORTHERN IRELAND (BELTURBET, CO. CAVAN).—Town hall and courthouse for the U.D.C.; P. J. Brady, architect, Ballyhaise.

ONGAR.—Headquarters for anti-aircraft searchlight company, for Essex Territorial Army Association; H. R. Bird, architect, Brentwood (returnable deposit of £2 2s.).

OSWALDTWISTLE.—School (£21,000); Lancashire Education Committee. Clinic and welfare centre, Barnfield House Lancashire Education Committee.

OXFORD.—Municipal offices, Queen Street; City Estates Department.

PETERBOROUGH.—Town hall (£200,000), for the T.C.; E. Berry Webber, architect, Lincoln's Inn, London.

PORTSMOUTH.—182 houses, Milton (£85,000); city engineer. Steel framed sheds, Rudmore Road; Portsmouth Steel Co.

RADCLIFFE (LANCS.).—Housing scheme (50), for the U.D.C.; G. E. Wrigley, surveyor (returnable deposit of £2 2s.).

SANDWICH.—Additional 30 houses, for the T.C.; borough surveyor.

SELBY (YORKS).—Bakery, electrically equipped; proprietor, Mascot Café, Gowthorpe Street.

SHOREHAM (SUSSEX).—Additional 60 houses for the U.D.C.; surveyor. Electric light installation, electrical equipment for organ blowing, and heating apparatus, for the Parochial Church Council; vicar.

SLEAFORD.—County offices, Lafford Terrace; Kesteven County Education Committee.

SOUTHMOLTON (DEVON).—Houses (51) for the R.D.C.; Council surveyor.

SOWERBY (HALIFAX).—Additional 50 houses for the U.D.C.; surveyor.

STALYBRIDGE.—Extensions, Grosvenor Street; Stalybridge Co-operative Society, Ltd.

STOCKPORT.—Additional 54 houses, Didsbury Road, for the T.C.; borough surveyor.

SWANSCOMBE.—70 houses, Church Field; U.D.C. surveyor.

WELLS.—Complete electric wiring installation, Somerset and Bath Mental Hospital; H. T. Sully, consulting electrical engineer, Scottish Widows' Buildings, Bristol (returnable deposit of £3 3s.).

WEYMOUTH.—Central school; Education Committee.

WHITCHURCH (SALOP).—Houses (42), for the U.D.C., George Edge, Son & Davies, builders.